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computing today

FOR THE BUSINESS OF MICROCOMPUTING

SEPTEMBER 1981
ISSN 0142-7210
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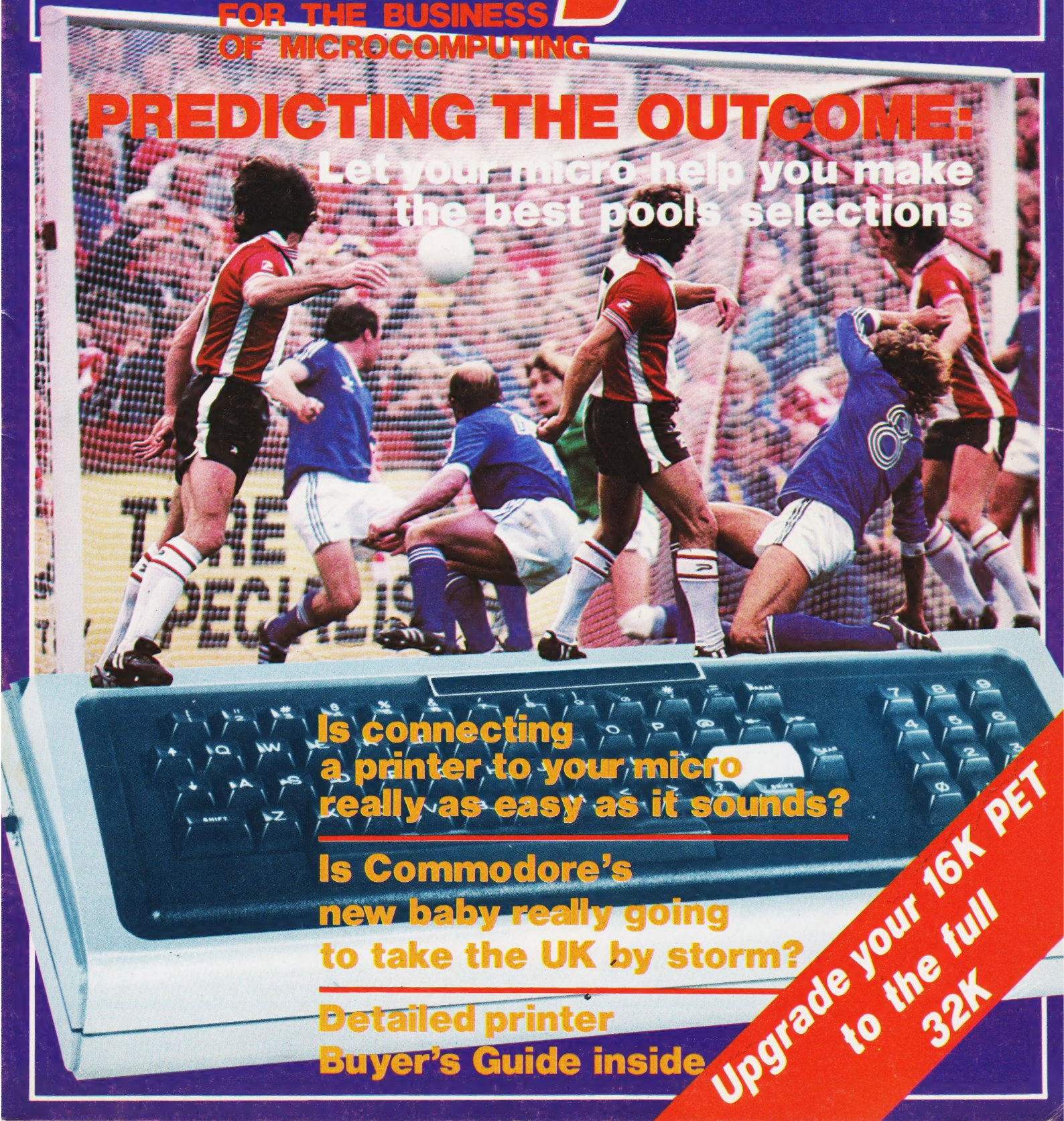

PREDICTING THE OUTCOME:

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Is connecting a printer to your micro really as easy as it sounds?

Is Commodore's new baby really going to take the UK by storm?

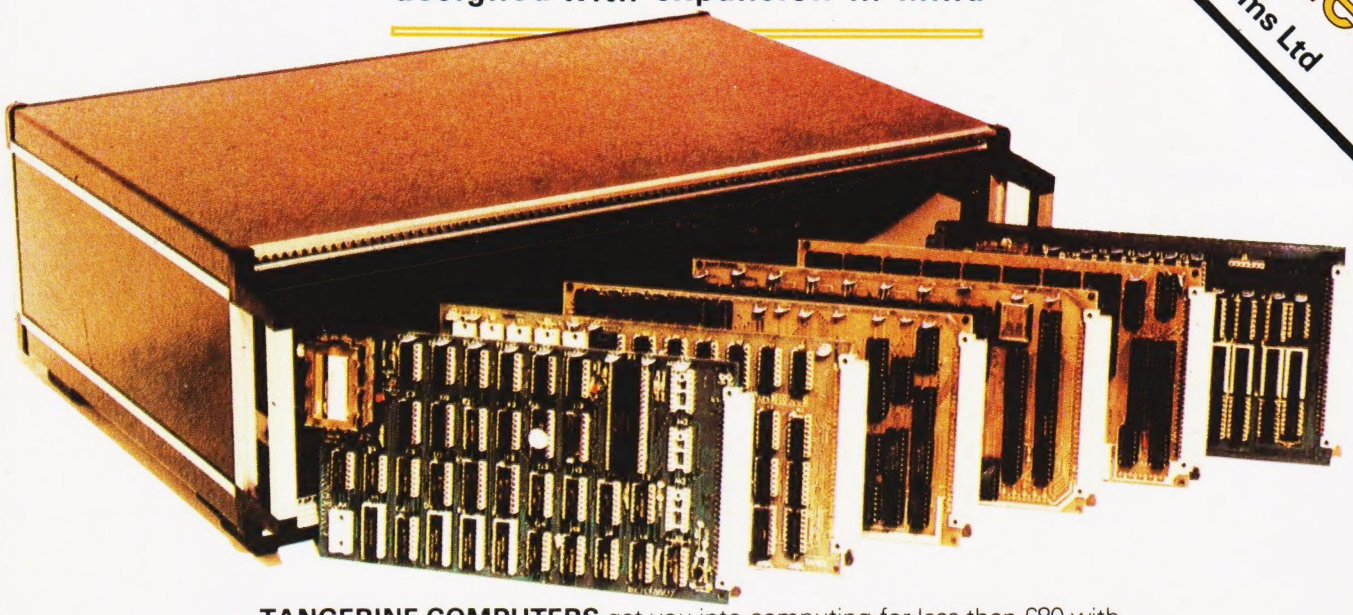
Detailed printer Buyer's Guide inside

Upgrade your 16K PET to the full 32K

microtan

designed with expansion in mind

Tangerine Computer Systems Ltd



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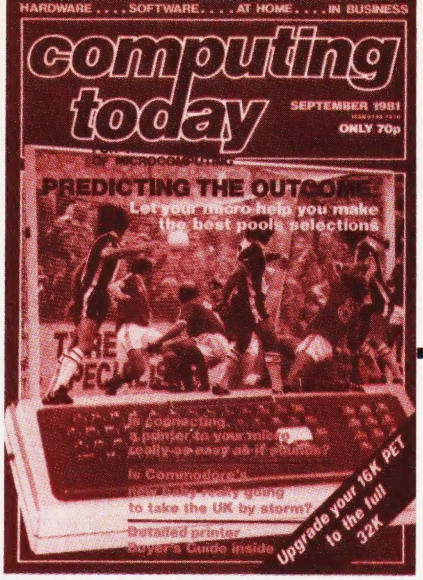

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VOL 3 No 7 SEPTEMBER 1981

EDITORIAL & ADVERTISEMENT OFFICE
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Telephone 01-437-1002-7. Telex 8811896.

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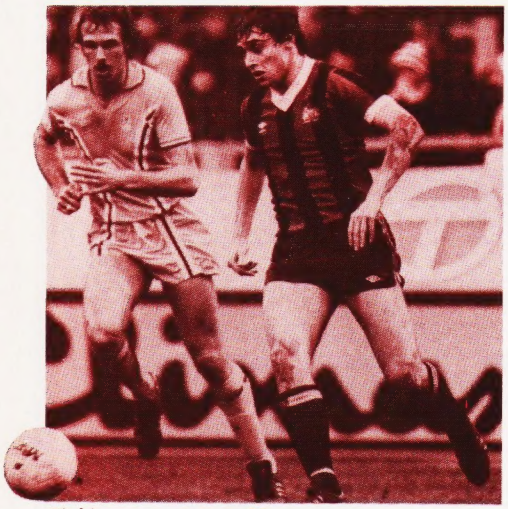
Circus Maximus p32



Kicking up a storm p52

VIC's here p73

Computing Today is constantly on the look-out for well written articles and programs. If you think that your efforts meet our standards please feel free to submit your work to us for consideration.

All material should be typed, but neat hand-written copy may be considered. Any programs submitted must be listed, cassette tapes and discs will not be accepted, and should be accompanied by sufficient documentation to enable their implementation. Please enclose an SAE if you want your manuscript returned, all submissions will be acknowledged. Any published work will be paid for.

All work for consideration should be sent to the Acting Editor at our Charing Cross Road address.

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ABC Member of the Audit Bureau of Circulation

Computing Today is normally published on the second Friday in the month preceding cover date.
Distributed by: Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS. 01-247 8233.
Printed by: Alabaster Passmore & Sons Ltd, Maidstone, Kent.

Subscription Rates : UK £11.25 including postage. Airmail and other rates upon application to Computing Today Subscriptions Department, 513 London Rd, Thornton Heath, Surrey CR4 6AR.

The VIC centre
It's the add on to start with for your VIC-20

When it comes to looking at what the incredible VIC-20 has to offer, there's one cost-free add-on it will pay you to consider right from the start – The VIC Centre. Established by Adda Microshops Ltd, part of the successful Adda Computers group, The VIC Centre aims to offer the kind of service you'll not find anywhere else in the country.

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If you want to get to the heart of what the VIC-20 system is all about then go straight to the centre – The VIC Centre – and join our information service now.

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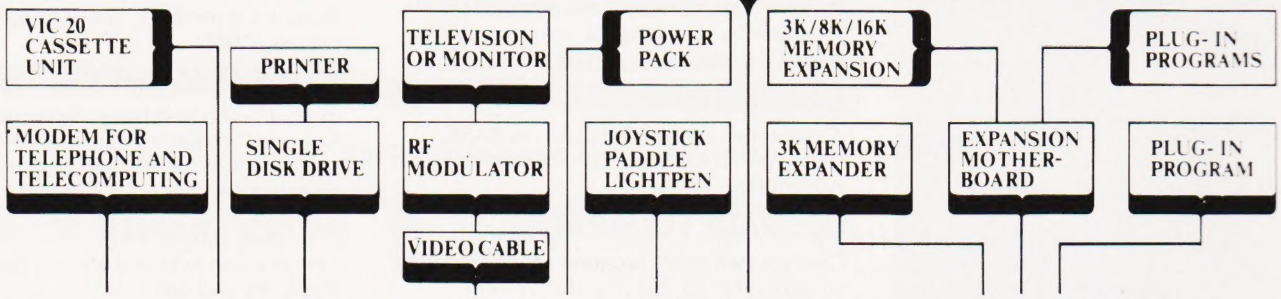

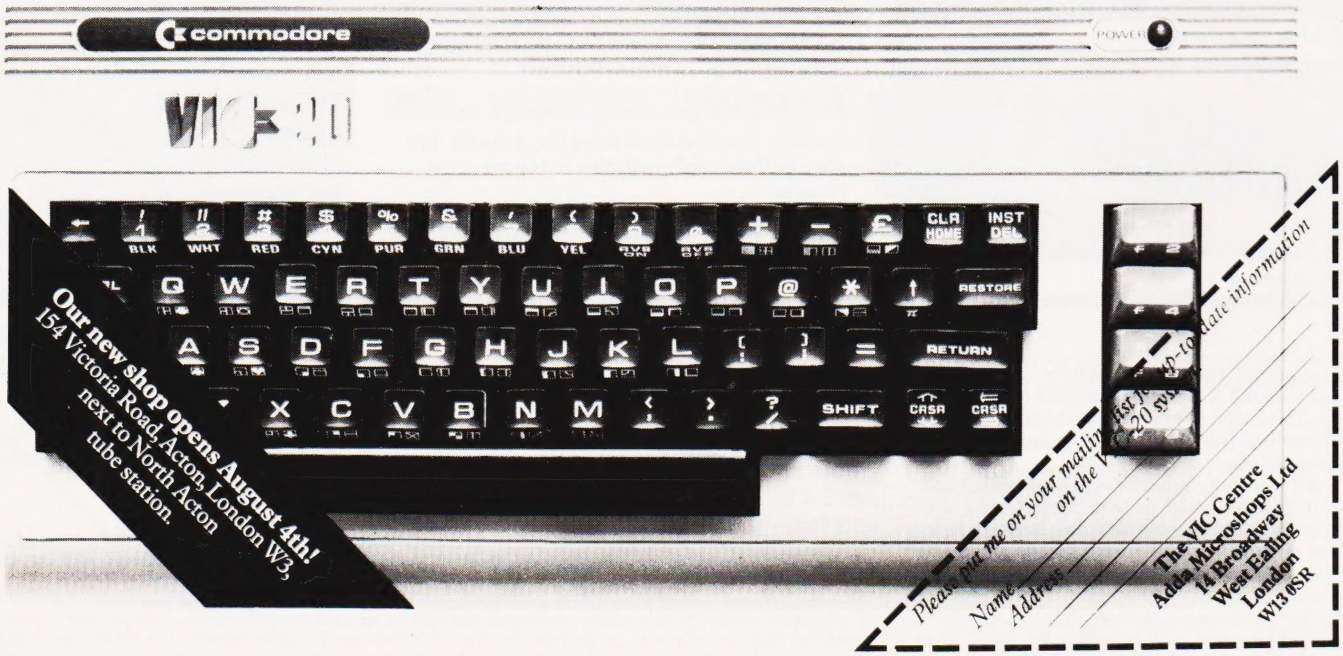

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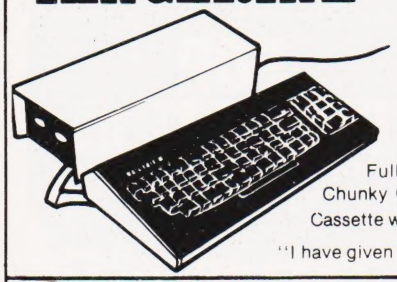


microtan 65 — £69

Microtan 65 is the most advanced, most powerful, most expandable microcomputer available —it also happens to be the most cost effective.

6502 Microprocessor IK Tanbug IK User RAM Full TV Display **£79** (ready-built). 20-way KEYPAD—**£10.**
TANEX—£43
IK 16 parallel 1/0 lines. Cassette Interface—1 serial 1/0 line. 2 x 16 BIT counter timers OPTIONS TK RAM total—32 parallel 1/0 lines. 4 x 16 BIT counter timers—RS232. 20MA current loop.
10K MICROSOFT BASIC—£49
System Rack—**£49** in black/tangerine in brushed aluminium.
Full Ascii Keyboard with numeric pad—**£60.85.** Cabinet available—**£20.** Lower Case option—**£9.48.**
Chunky Graphics Pack—**£6.52.** Tanram Full Memory Expansion to 40K—**£119.00.** Mini Motherboard—**£10.00.**
Cassette with counter—**£21.70.**

"I have given TANGERINE five bonus points for getting just about everything right"—E.T.I. Mag., May 1980.

COMMODORE PET

Everything has been said about PET—Britain's number one selling microcomputer. A full range of accessories and software, (both games and business), is held in stock.

£399

8K Inbuilt Cassette—**£399,**
8K Large Keyboard—**£425**
16K Large Keyboard—**£499**
External Cassette—**£55**
Dual Disc Drive—**£695**
Tractor Printer—**£395**

CASSETTE SOFTWARE: Strathclyde Basic Course, Basic Basic Course, Invaders, Treasure Trove of Games 1 to 10 (10 selections of games), Basic Maths, Algebra, Statistical Packs and lots more!

£599

apple

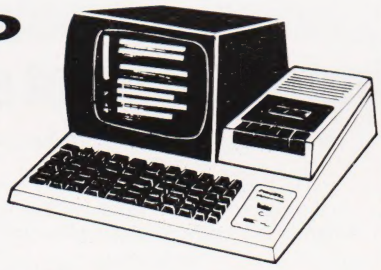
The Apple II + is more powerful than its predecessors with built-in sound and high resolution graphics, which make it ideal for scientific and games applications.

APPLE 16K—**£599**
APPLE 32K—**£649**
APPLE 48K—**£659**
Epsom Printer—**£349**

Cassette with counter—**£21.70**
Disc drive without controller—**£299**
Disc drive with controller—**£349**
16K add-on—**£69**

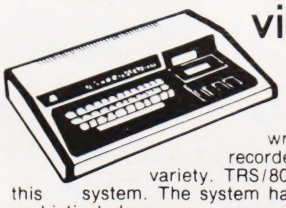
CARDS: Prototype/hobby card—**£15,** parallel printer interface card—**£104,** communications card—**£130,** high speed serial interface card—**£113,** Pascal language system—**£299.**

SHARP



MZ80 20K	£449
36K	£475
48K	£495
Printer	£475
Dual disc drive	£715

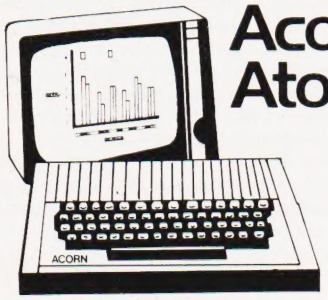
video genie system



The **Video Genie** system has many uses in all spheres of life, the easy to use BASIC language means that programmes are easily written for specific applications, and pre-recorded programme tapes are available in great variety. TRS/80 software can be used with this system. The system has great scope in the home, sophisticated games programmes can introduce the computer age to all the family, who can then progress to writing their own programmes in BASIC or even machine code. Software is continuously being developed to aid home budgeting and education.

£299

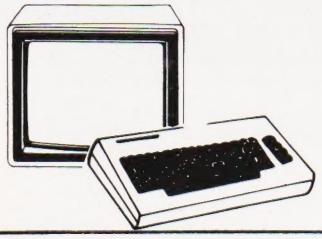
Acorn Atom



The ATOM is a British-designed personal computer—simple to operate, and in kit form, simple to build. It has all the features found in machines twice the price or more, and yet it has one outstanding advantage. It is designed on an expandable basis.

Atom kit 8K ROM 2K RAM	£ 120
assembled	£ 150
kit 12K ROM 12K RAM	£ 220
assembled 12K ROM 12K RAM	£ 250
1K RAM set	£ 9.50
4K Floating Point ROM (included in 12K version)	£20.00
Printer drive	£ 9.00
LS244 buffer	£ 2.50
Colour encoder	£19.00
Mains PSU	£ 8.00

COMMODORE VIC



Commodore International Ltd. (AMEX-CBU) has officially introduced the world's first full-featured colour computer priced at under £200.

The new VIC 20, which retails at £199.00 was unveiled on January 8th at the Consumer Electronics Show in Las Vegas.

The new computer puts Commodore squarely in the low priced personal computer market with a fully expandable microcomputer which connects to any television set and rivals the features of existing microcomputers selling at four or five times the price. The features speak for themselves:

- colour
- sound
- programmable function keys
- 5K memory expandable to 32K
- standard PETBASIC
- full-size typewriter keyboard
- graphics character set
- plug-in programme/memory cartridges
- low-priced peripherals
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IMPROVING ON PET

Not so simple

Choosing a computer is... Choosing a computer is more than just choosing a computer. That is, it's a lot more than just hardware. Mind you, PET stacks up very well when it comes to the computer itself. Because at Commodore we've been involved with microcomputers for over 20 years – in fact, many other manufacturers pay us the compliment of using our microchip for their own computers.

So, when you choose PET you know you have a microcomputer that everyone in the business admires and respects.

...choosing software... Our software programs live up to the quality of our computer. The range, from both Commodore and specialist suppliers, covers everything from word processing, stock control and payroll to accounting and information processing. As well as specialist applications for education and the sciences.

For light relief, we've a pretty impressive range of games and other brain-teasing packages.

...choosing value... Our computers start at under £200 and go through to £3000 – which will buy you a complete business system. The extent of our range makes sure that you'll easily be able to choose the right computer for your individual needs.

...choosing a dealer... As you can see, you do get nationwide dealer back-up with Commodore. What's more, many of our dealers have specific expertise – which means they can advise on anything from business systems to specialist technical applications. So, if your particular problem is of a highly specialised nature, it may be best to contact our Information Department direct. They will then recommend the dealers who understand – and who speak your kind of language.

...choosing your computer... It all adds up. By choosing a PET you're getting the kind of systems and service that you'd expect from Britain's biggest selling microcomputer.

Send to: Commodore Information Services, P.O. Box 109, Baker Street, High Wycombe. Tel: Slough 79292.
I'd like to know how a Commodore PET will make choosing a computer simple for me.

Name.....

Company.....

Address.....

Tel:..... 24 CT1

COMMODORE PET
Quite simply, Britain's biggest selling microcomputer

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NW1, 01-387 0505
Capital Computer Systems Ltd
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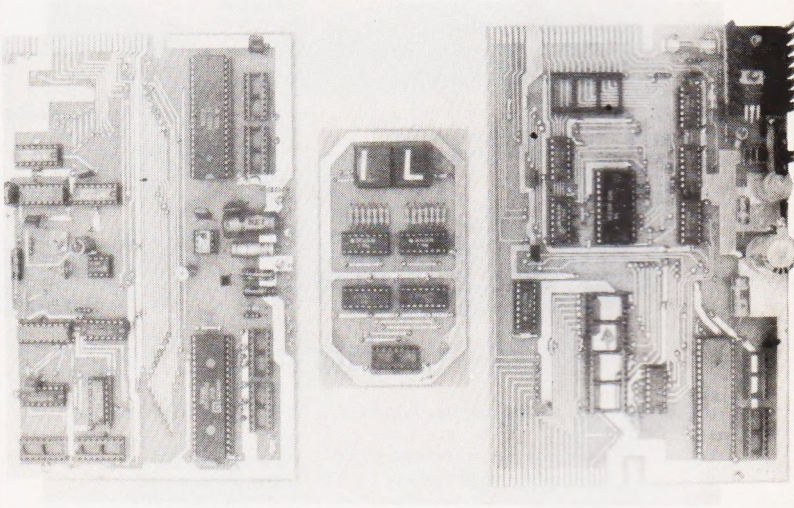
NORTHERN IRELAND
Northern Ireland Computer Centre Limited
HOLYWOOD, (02317) 6548

GIVING IT AWAY

Our illustrious sister magazine, ETI, is featuring a competition this month that may well appeal to the active programmers among you. Their main feature is a robot arm project and the competition is to write software to drive it from any of the common personal computers; PETs, Tandys, RML 380Zs, MICRONs etc etc. Full rules are published in ETI but essentially all programs must be supplied in listed form with full documentation. Cassettes and discs are NOT acceptable as entries although they may be used to support entries on PET and Sharp systems. There is a first prize of £100 so get coding.

THREE FOR TWO

A new set of interface boards for the Superboard II and UK 101 has been introduced by Technomatic. Connecting directly to the expansion socket they offer additional user ports, a sound generator, a D to A and an A to D. All are accessible from BASIC and machine code programs. A 50-page booklet describes the applications to which they can be put and a set of 27 programs is also available on cassette. The system comprises a decoding module at £27.50, an analogue board at £47.50 and a display board at £9.50. The cassette costs £3.50 and all prices are exclusive of VAT. For further information contact Technomatic at 17 Burnley Road, London NW10 1ED or ring on 01-452 1500.



ON COURSE

With the continuing shortage of trained programmers and systems analysts in the computer market, not to mention the considerable understaffing in other areas, it is nice to see some more courses appearing. Slough College of Further Education are offering a wide range of courses including a TOPS supported Higher TEC in Computer Technology and an HND in Computer Studies. Interviews will start in September for the January 1982 courses and information can be obtained from Dr E Huzan, Head of Computing Division, Slough College of Further Education, Wellington Street, Slough, Berks SL1 1YG. Computer based training is the subject of a one-day workshop and a two-day course being organised by Mills and Allen Communications. The workshop is on 30th September and the course runs on 1st and 2nd October. Full details from Sue Punch at Mills and Allen Communications, 1-4 Langley Court, Long Acre, London WC2E 9JY or ring on 01-240 1307. The Society of Industrial Artists and Designers are running a third series of one-day courses on Computer Typography. Dates are December 16th, February 9th, March 19th and 26th and June 25th, all but the first are in 1982, of course. The cost is £70 inclusive for non-members and £40 for SAID members. Information from Susan Hirst, Education and Training Department, SAID, 12 Carlton House Terrace, London SW1Y 5AH or telephone on 01-930 1911.

NCC EVENTS

The new Microsystems Centre has announced its Autumn training programme for secretarial people who may be asked to advise on word processing equipment. There is a one-day course on September 7th or you can go for five one and a half hour evening sessions starting on 17th September. The cost is £50 for both methods. Wednesday September 2nd is the date for a one-day workshop on Microcomputer Appreciation for Managers. Both of the above are to be held in the Centre at 11 New Fetter Lane, London EC4A 1PU. Other courses and seminars scheduled for September include Computer Based Training, Electronic Office Systems, CP/M In Practice and Elementary BASIC Programming. Full details and prices can be obtained from the above address or by ringing on 01-353 0013, or by contacting the NCC direct at Oxford Road, Manchester M1 7ED or telephone on 061-228 6333.

WRAPPING IT UP

A prototyping kit to introduce electronic engineers to the technology of solder-wrapping has been launched by Pye Borders Electronics. All the necessary components and tools are included allowing a single Eurocard to be equipped with up to 40 16-pin DIP sockets. The nearest equivalents to this system currently available are those supplied by Vero Electronics and T J Brine's Roadrunner. Pye Borders are also offering an automatic wiring service for large production runs as an alternative to PCB type production systems. For further information contact them at Pinnacle Hill Industrial Estate, Kelso, Roxburghshire TD5 8DW.

CPU UPGRADE

The ever popular Z80 CPU has been available in 2 and 4 MHz versions for quite a while now but if this still isn't fast enough you can buy a 6 MHz variant called the Z80B. Fully compatible with the existing types and all peripheral devices it is now available through Hi-Tek Distribution, Trafalgar Way, Bar Hill, Cambridge CB3 8SQ.

CONSUMER NEWS

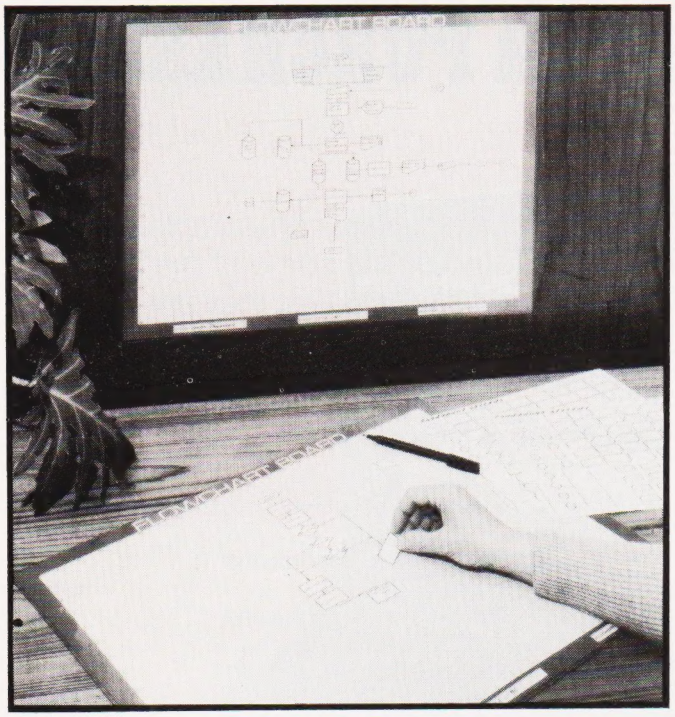
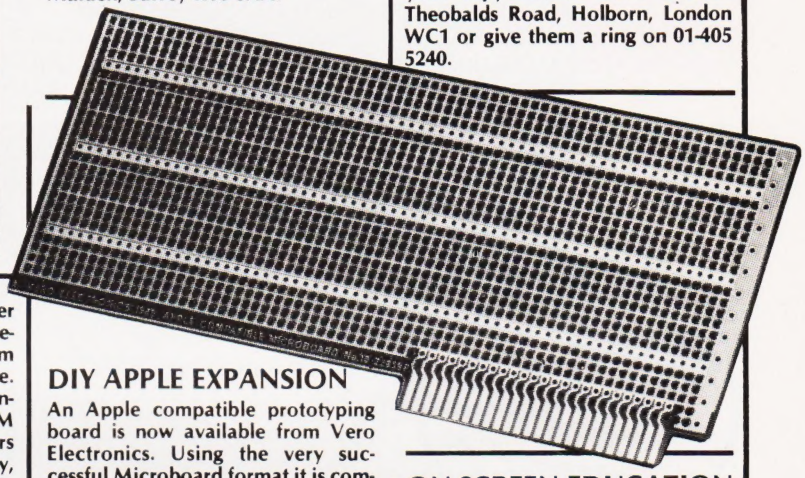


CHART ART

A new programming aid has been introduced for the serious programmer or small software house. It consists of a large laminated work-board and sheets of cling-plastic symbols. Annotations and flowchart lines are drawn in with special marker pens and the board can be wiped clean after use. To make a permanent record a photocopy can be taken. Originally developed for in-house use by Data Communications it proved so successful that they set up a special company to market it. The board and two sets of symbols costs £23.72 inclusive. For more information contact Flowchart Systems at Datarite House, Grafton Road, New Malden, Surrey KT3 3AA.

WHISTLE STOP TOUR

The latest catalogue from Transam offers some solace for those who can't afford to get to London to look at their Tuscan computer. It is currently on-board the MAP train making a 21 week tour round the country. At the time of reading the train is just about half-way round with the next scheduled stops as Aberdeen, Dundee, Newcastle and Middlesbrough. If you have a Prestel set you can check the progress with a quick *204200#. The catalogue lists all the hardware and ancillaries which Transam produce with the notable exception of their original Triton, the 8080 based system produced in conjunction with ETI. For your copy contact them at 59/61 Theobalds Road, Holborn, London WC1 or give them a ring on 01-405 5240.



DIY APPLE EXPANSION

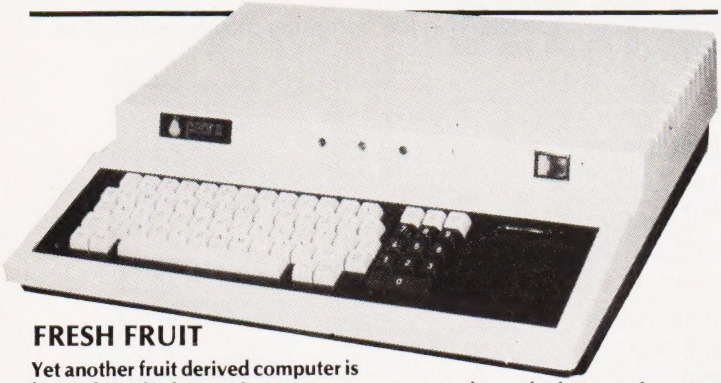
An Apple compatible prototyping board is now available from Vero Electronics. Using the very successful Microboard format it is complete with a colander ground plane and gold plated connectors and should be readily available from your local stockists. Also using the Microboard format is an S100 compatible board that has space dedicated for on-board regulators and their associated heatsinks. The third recent offering is a KM6 case frame that can be rack mounted. Fully compatible with the existing free-standing versions, it allows Eurocard systems to be permanently installed. If you have any difficulties in supply or obtaining further information contact Vero direct at the Industrial Estate, Chandler's Ford, Hants S05 3ZR.

ON-SCREEN EDUCATION

If you own or rent a VCR and want to learn BASIC then a new-style programming course may be of interest. Just introduced by Guild Sound & Vision it consists of a set of four video cassettes, a manual and a set of exercise sheets which cost £180 per set to schools and £240 to individual customers. These prices are for VHS and Betamax systems: others are available. The next course to be released will be on Pascal. More information is available from Guild Sound & Vision at Woodston House, Oundle Road, Peterborough PE2 9PZ or give them a ring on 0733-63122.

OF MICE AND MEN!

Supersoft have recently launched what might well be two winners for the PET. First, in the software field: an adventure game that, unlike most previous games of this type, is supplied on cassette not disc. It requires 32K of RAM and as there are no graphics so it will work on 40 or 80 column machines. It is called 'The Hitch Hiker's Guide To The Galaxy' and loosely uses scenarios from the well known book. Like others of the genre it requires you to search for and use various items scattered between here and the end of the universe. You will have to decide just what to do with your 'towel', 'rubber duck' and a 'bowl of petunias' not to mention those wandering 'white mice' and 'Marvin the Robot'. Movement throughout the galaxy is logical and repeatable and you may store your current status on tape for later re-entry. Price £16 plus VAT. The second item of interest comes from Supersoft's growing firmware stable. ARROW is yet another chip to fit into one of your PET's spare ROM sockets (if you have any left!) It offers facilities such as optional repeat key, hexadecimal calculator, double density plotting, tape positioning and ... wait for it ... hyperspeed (Supersoft's term) cassette LOAD, SAVE, VERIFY and APPEND. Under ARROW control you can LOAD, SAVE etc a program at about six (yes, six) times faster than normal. When you next LOAD a 16K program get out your stop-watch and time it ... then contact Supersoft for the latest price of ARROW. Their location is on the First Floor, 10-14 Canning Road, Wealdstone, Harrow, Middlesex HA3 7SJ.



FRESH FRUIT

Yet another fruit derived computer is being launched into the European marketplace, the Pear II. If the name sounds a little similar to one you already know and the logo looks rather familiar as well — don't let yourself be fooled. Based on the 6502 processor and complete with full PAL colour graphics the Pear is a cased system with 32K of RAM, expandable to 96K, 24 by 40 screen display, 14 expansion slots and quite a lot more besides. Deliveries will start at the end of September at a cost of £975 excluding VAT. The supplied language is BASIC with COBOL available provided the Z80 'softcard' is installed. Other options include an EPROM programmer, joystick and the facility to re-program the character set to suit your requirements. For further information contact Pearcom Ltd at 17 Nobel Square, Basildon, Essex SS13 1LP.

IMPORTANT NOTICE TO ALL MICRO-COMPUTER PURCHASERS

The BBC Micro-computer System

In September 1981 the new BBC Microcomputer* goes into production. It will be available by mail-order from the end of October. We believe that this computer will far out-perform any other machine at a remotely comparable price. We have listed below some of the many features, and suggest that they are considered by anyone choosing a computer for home, school or business use.

- Full QWERTY keyboard with full cursor controls and 10 user programmable keys. Sealed contact switch construction tested to a minimum of 3,000,000 operations.
- Built-in power supply.
- RAM expandable to 32K bytes.
- ROM expandable to 48K bytes.
- Second 8-bit processor option with up to a total of 96K RAM.
- 16-bit processor expansion with up to 8 Megabytes of RAM.
- Cassette and disk interface and filing system.
- Teletext and Prestel (Viewdata) interfaces.
- Networking facility (Econet).
- RS232 Interface.
- Centronics printer interface.
- Analogue to Digital Interface (Paddle or joystick).
- Built-in loudspeaker and sound generator.
- Voice synthesiser.
- Elapsed time clock.

A full range of peripherals including printers, disks, monitors will be available for business use.

Regional advice centres for educationalists and user groups for hobbyists are being established.

Nationwide servicing facilities.

VDU modes as follows:

Memory mapped, transparent access with eight formats:

1. 640 x 256-2 colour graphics and 80 x 30 text (20K)
2. 320 x 256-4 colour graphics and 40 x 32 text (20K)
3. 160 x 256-16 colour graphics and 20 x 32 text (20K)
4. 80 x 25-2 colour text (16K)
5. 320 x 256-2 colour graphics and 40 x 32 text (10K)
6. 160 x 256-4 colour graphics and 20 x 32 text (10K)
7. 40 x 25-2 colour text (8K)
8. 40 x 25 teletext compatible (1K)

Operates in a microsoft-type basic extended to provide unrestricted variable names; multi-line statements, functions and procedures with local variables; powerful string handling; built-in mnemonic assembler and features for structured programming.

Pascal in ROM available as a second language.

This computer system has been developed as part of the computer literacy project to be launched on BBC 1 in January 1982. The project also includes a 10-part television series, a book, a 30-hour course in programming in BASIC and a range of applications software.

Secondary schools buying this computer may qualify for the 50% DOI grant.

For more details of the BBC Microcomputer System just fill in the coupon below and send it to:
BBC, Box No 7, London W3 6XJ

Please send me more details of the BBC Microcomputer System.

Name _____

Address _____

_____

_____

Postcode _____

CT/9/81

BBC

*Designed and made under license from BBC Enterprises Ltd by Acorn Computers Ltd of Cambridge.

THE SHARP MZ-80K HAS GOT IT ALL

Since its introduction the Sharp MZ-80K has proved to be one of the most successful and versatile microcomputer systems around. Sharp now have a comprehensive range of products ready to make the powerful MZ-80K with its Printer and Disc Drives even more adaptable.

Products include:- Universal Interface Card, Machine Language and Z-80 Assembler packages, CP/M* plus a comprehensive range of software.

*Trade mark of Digital Research Ltd.

You'll find all the help and advice you need about the MZ-80K at your Specialist Sharp Dealer in the list below.

If there is no dealer in your area, or if you require any further information write to:- Computer Division, Sharp Electronics (UK) Ltd., Sharp House, Thorp Road, Newton Heath, Manchester M10 9BE.

SHARP
First, and foremost

GET IT ALL HERE...

AVON
BCG Shop Equipment Ltd
Bristol, Tel: 0272 425338
Decimal Business M/Cs Ltd
Bristol, Tel: 0272 294591
BEDFORDSHIRE
H.B. Computers (Luton) Ltd
Luton, Tel: 0582 416887
BERKSHIRE
Newbear Computing Store Ltd
Newbury, Tel: 0635 30505
BIRMINGHAM
Camden Electronics
Small Heath, Tel: 021-773 8240
E.B.S. Ltd
Birmingham, 1, Tel: 021-233 3045
Electronic Business Systems Ltd
Birmingham, Tel: 021-384 2513
Jax Rest Ltd
Birmingham, Tel: 021-328 4908
Newbear Computing Store Ltd
Birmingham B26, Tel: 021-707 7170
BUCKINGHAMSHIRE
Interface Components Ltd
Amersham, Tel: 02403 22307
CHESHIRE
Charlesworth of Crewe Ltd
Crewe, Tel: 0270 56342
Cash Register Services
Chester, Tel: 0244 317549
Cheshire Computer Services Ltd
Levenshulme, Tel: 061-225 4763
Fletcher Worthington Ltd
Hale, Tel: 061-928 8928
Newbear Computing Store Ltd
Stockport, Tel: 061-491 2290
Ors Group Ltd
Warrington, Tel: 0925 67411
CLEVELAND
Hunting Computer Services Ltd
Stockton-on-Tees, Tel: 0642 769709

DERBYSHIRE
Chandos Products
New Mills, Tel: New Mills 44344
Lowe Electronics Ltd
Matlock, Tel: 0629 2817
DEVON
Crystal Electronics Ltd
Torquay, Tel: 0803 22699
Plymouth Computers
Plymouth. Tel: 0752 23042
EXETER
Peter Scott (Exeter) Ltd
Exeter, Tel: 0392 73309
DORSET
South Coast Business M/Cs
Ferndown, Tel: 0202 893040
ESSEX
Prorole Ltd
Westcliff-on-Sea, Tel: 0702 335298
GLOUCESTERSHIRE
Gloucestershire Shop Equipment Ltd
Gloucester, Tel: 0452 36012
HAMPSHIRE
Advanced Business Concepts
New Milton, Tel: 0425 618181
Xitan Systems Ltd
Southampton, Tel: 0703 39890
KENT
Video services (Bromley) Ltd
Bromley, Tel: 01-460 8833
LANCASHIRE
B & B Computers Ltd
Bolton, Tel: 0202 26644
H. R. Control Systems Ltd
Chorley, Tel: 02572 75234
Sound Service
Burnley, Tel: 0282 38481
Sumita Electronics Ltd
Preston, Tel: 0772 51686
The Micro Chip Shop
Blackpool, Tel: 0253 403122

LEICESTERSHIRE
Gilbert Computers
Lubenham, Tel: 0858 65894
G.W. Cowling Ltd
Leicester, Tel: 0533 556268
Leicester Computer Centre
Leicester, Tel: 0533 556268
Mayes Hi Fi
Leicestershire, Tel: Leics 22213
LINCOLNSHIRE
Howes Elect. & Autom. Servs.
Lincoln, Tel: Lincoln 32379
Z. R. Business Consultants
Lincoln, Tel: 0522 680087
LONDON
Bridgewater Accounting
Whetstone, Tel: 01-446 0320
Butel-Comco Ltd
Hendon, Tel: 01-202 0262
Central Calculators Ltd
London EC2, Tel: 01-729 5588
Digital Design & Development
London W1, Tel: 01-387 7388
Euro-Calc Ltd
London WC1, Tel: 01-405 3223
Euro-Calc Ltd
London EC2, Tel: 01-729 4555
Euro-Calc Ltd
London W1, Tel: 01-636 5560
Lion Computer Shops Ltd
London W1, Tel: 01-637 1601
Personal Computers Ltd
London EC2, Tel: 01-626 8121
Hart House
London EC2, Tel: 01-729 3035
Sumlock Bondain Ltd
London EC1, Tel: 01-253 2447
Scope Ltd
London EC2, Tel: 01-729 3035

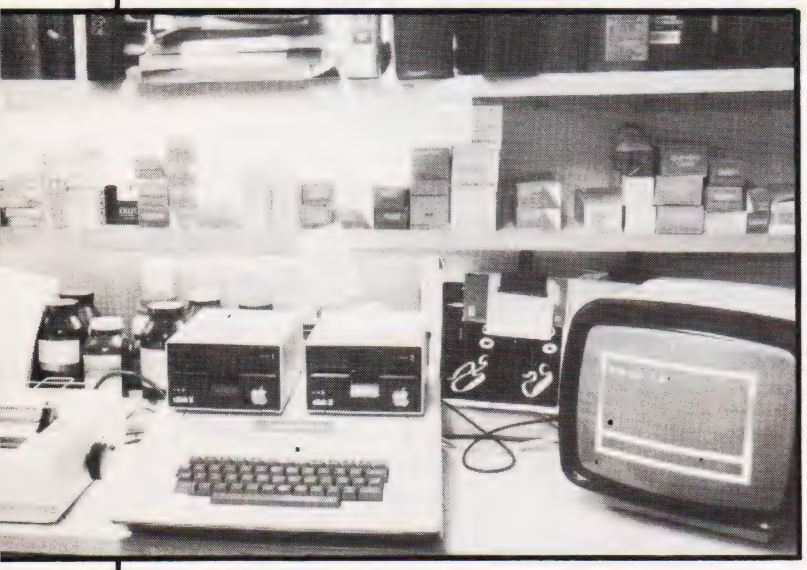
MANCHESTER
Sumlock Electronic Services Ltd
Manchester M3, Tel: 061-834 4233
Sumlock Software Ltd
Manchester M3,
Tel: 061-228 3502
MERSEYSIDE
Microdigital Ltd
Liverpool, Tel: 051-227 2535
Sota Communication Systems
Liverpool L14, Tel: 051-480 5770
NORFOLK
Sumlock Bondain (East Anglia)
Norwich, Tel: 0603 26259
NORTHAMPTONSHIRE
Computer Supermarket
Corby, Tel: 05366 62571
H.B. Computers Ltd
Kettering, Northamptonshire,
Tel: 0536 520910
NORTHERN IRELAND
Bromac (U.K.)
Co. Antrim, Tel: 023831 3394
O & M Systems
Belfast, Tel: 0232 49440
The Microcomputer Centre (N.1.)
Belfast, Tel: Belfast 682277
NOTTINGHAMSHIRE
Mansfield Business M/C Ltd
Mansfield, Tel: 0623 26610
OXFORDSHIRE
Oxford Computer Centre
Oxford, Tel: 0865 45172
or 0865 49349
REPUBLIC OF IRELAND
O'Connor Computers Ltd
Galway, Tel: 0009 61173
Tomorrows World Ltd
Dublin 2, Tel: 0001 776861

SALOP
Computer Corner
Shrewsbury, Tel: 0743 59788
SCOTLAND
A & G Knight
Aberdeen, Tel: 0224 630526
Business and Electronics M/Cs
Edinburgh, Tel: 031-226 5454
Micro Centre
Edinburgh, Tel: 031-556 7354
Microforth
Dunfermline, Tel: 0383 34954
Moray Instruments Ltd
Elgin, Tel: 0343 3747
Pointer Business Equipt Ltd
Glasgow, Tel: 041-332 3621
Tyseal Computers Ltd
Aberdeen, Tel: 0224 573111
SOMERSET
Norsett Office Supplies Ltd
Cheddar, Tel: 0934 742184
SOUTH HUMBERSIDE
Silicon Chip Centre
Grimsby, Tel: 0472 45353
STAFFORDSHIRE
W. B. Computer Services
Cannock, Tel: 0543 75555
SUFFOLK
C. J. R. Microtek Co. Ltd
Ipswich, Tel: 0473 50152
SURREY
R.M.B. Ltd
Croydon, Tel: 01-684 1134
Saradan Electronic Services
Wallington, Tel: 01-669 9483
T & V Johnson (Microcomputers)
Camberley, Tel: 0276 20446

SUSSEX
Gamer
Brighton, Tel: 0273 698424
Jax Rest Ltd
Brighton, Tel: 0273 687667
M & H Office Equipment
Brighton, Tel: 0273 697231
Oval Automation
Worthing, Tel: 0903 501355
WALES
Limrose Electronics Ltd
Wrexham, Tel: 097 883 5555
Morriston Computer Centre
Swansea, Tel: 0792 795817
Sigma Systems Ltd
Cardiff, Tel: 0222 21515
WARWICKSHIRE
Business & Leisure Microcomputers
Kenilworth, Tel: 0926 512127
WORCESTERSHIRE
Capricom Computer Systems
Worcester, Tel: 0905 21541
YORKSHIRE
Bits & P.C's
Wetherby, Tel: 0937 63744
Datron Micro-Centre Ltd
Sheffield, Tel: 0742 585490
Huddersfield Computer Centre
Huddersfield, Tel: 0484 20774
Neecos (D.P.) Ltd
Darlington, Tel: 0325 69540
Superior Systems Ltd
Sheffield, Tel: 0742 755005
Ram Computer Services Ltd
Bradford, Tel: 0274 391166

ADDS ADD ON

The latest version of ADDS/VANTAGE software for the Multivision range of computers has a number of improvements. Still running under CP/M but with a number of additions such as the Target BASIC Interpreter and direct file access the systems software will be implemented in all the current range of commercial applications software. The Multivision range starts at around £5,000 for a basic system, and a four terminal package with 10Mb of disc storage will cost around £12,000. To improve the availability of the system ADDS have appointed Peters Business Systems as their regional distributor for the Sussex area. For general enquiries contact ADDS direct at 137-141 High Street, New Malden, Surrey KT3 4BH or ring them on 01-949 1272.



VISICALC UPGRADE

Another version of the evergreen Visicalc is now available. Compatible with Apple's DOS 3.3, the new package has the version code 1.4 and will cost around £150. Among the new functions supported are Boolean algebra, data interchange, improved reporting and the elimination of that annoying quirk which required you to turn the Apple off before loading another program. Personal Software, the people who produced it, have launched four new programs, Visitrend, Visidex, Visiterm and Visiplot. The names are fairly self-explanatory and prices range between £123 and £210. All the above are available from Personal Computers Ltd, 194-200 Bishopsgate, London EC2M 4NR or you can phone on 01-626 8121.

LET IT FLOW

As an alternative to tying up your computer's time in formatting text output for the high quality printer you could consider a new British enhancement to the Ricoh 1600 daisywheel printer. The Flowriter, as it is called, is an intelligent printing terminal using two CPUs and an 8K buffer to store down-loaded text. The internal program is capable of responding to both Diablo and Qume commands and interfacing can be through RS232, IEEE-488 or Centronics ports, all of which are supplied. Development of the system was carried out by Small Systems Engineering and Appropriate Technology and further information can be obtained from the latter company at 9 Poland Street, London W1 or give them a ring on 01-437 8954.

PILL POPPERS

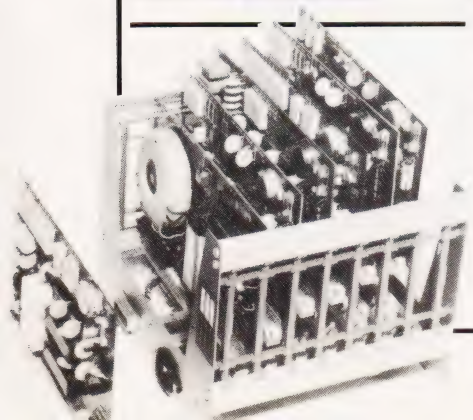
Pharmacies seem to be a popular place to install micros. The latest offering for this type of High Street outlet comes from Micro Management of Princes Street, Ipswich, Suffolk. The original software was developed for a local client on an Apple system and cost some £2,500. Facilities include label printout for drug dispensing, inventory of drugs supplied and the facility to check for overstocks — it is estimated that many chemists are some £10,000 overstocked in any given year. If you are interested in this application or any of the others that Micro Management can offer then contact them at the above address.

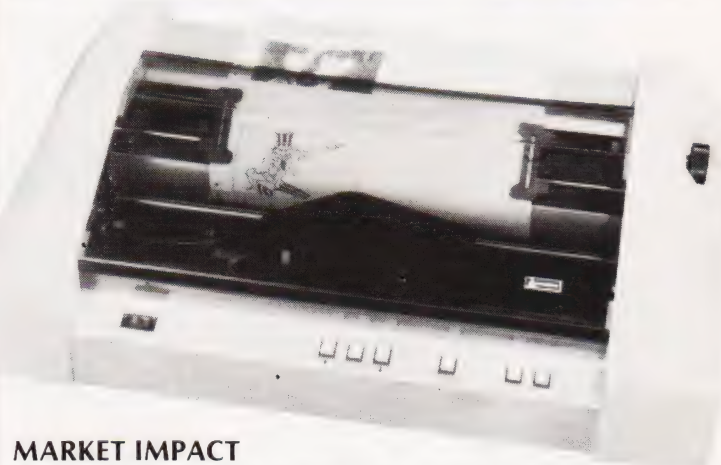
EXHIBITIONISM

Hailed as the first computer and business efficiency exhibition to be held in South East Essex, Combex will be running between 10th and 13th September. Although Combex is a Trade Fair invited visitors will be admitted, so drop a line to Ted North at Modern Living, 497 London Road, Westcliff-on-Sea, Essex.

INDUSTRIALISATION

If your production or manufacturing facility needs a micro to look after the boring bits then a new product from Machsize could provide part of the answer. Based on a cardframe with an inbuilt power supply and an IEEE decoder, it can accept up to five plug-in boards such as an A to D, a D to A or a variety of other industrial interfaces. The IEEE bus connects directly to micros like the HP85 or the PET and forms a data highway for information to pass to and from the equipment under control. Price of the basic rack is £350 with the boards extra. For details contact Machsize at York House, Clarendon Avenue, Leamington Spa, Warwickshire CV32 5PP or ring on 0926-312542.

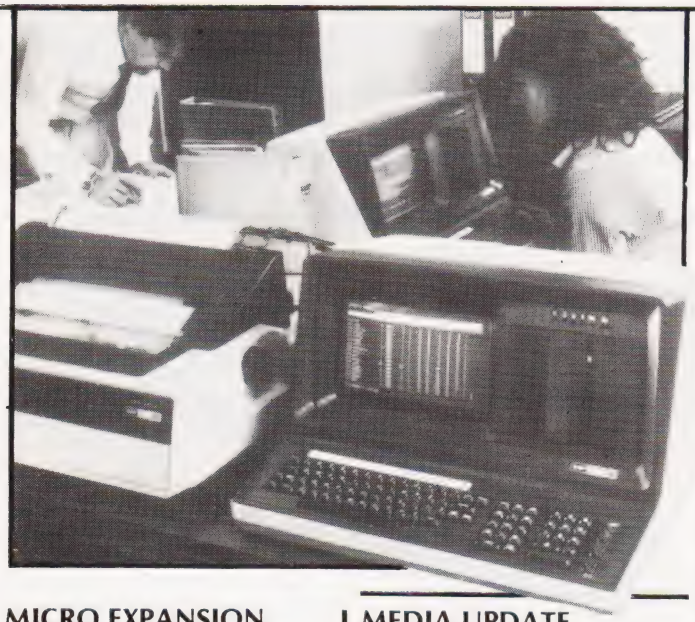




MARKET IMPACT

Microsense, the soon-to-be 'English Apple', have started to distribute Anadex's range of dot matrix printers. The four models selected for release are the 9000, 9001, 9500 and 9501. Full details of these can be found in our Buyer's Guide at the back of this issue — the prices are £795, £895, £895 and £995 respectively. One rather interesting item of news concerning Apples is that the current 'price war' appears to be making a large dent in the official distributor's share of the market. Indications are that some 25% of Apples bought in recent months have been supplied through the cut-price network. If you are in the throes of considering buying an Apple you appear to have two options — pay the full price and get the service, or pay less and take the risk of having to pay extra if the system fails after delivery. For details of the Anadex printers and your local official stockist contact Microsense Computers at Finway Road, Hemel Hempstead, Herts HP2 7PS.

BUSINESS NEWS



APL SEMINAR FOR DP USERS

I P Sharp, the well known APL timesharing consultancy, are running a one-day seminar on September 22nd for DP Consultants who use APL. The idea is to bring them up to date with the latest enhancements in the language and to show these enhancements in operation. If you or your company makes heavy use of APL then contact Molly Donelly at 132 Buckingham Palace Road, London SW1 or give her a ring on 01-730 0361.

SWITCH FOR POWER

Dialogue marketing are now stocking a switch-mode power supply especially for Winchester type discs. Designated the Conver AC-160 it can supply 24 V at up to 7 A for the drive and ± 12 and ± 5 V for the interface circuitry. All regulations are ± 5% except the + 12 V rail which is stabilised to ± 0.5% for use on a CRT. Full technical details from Dialogue Marketing at Unit 11A, Rose Industrial Estate, Bourne End, Bucks or ring on 06285-29222.

MICRO EXPANSION

BASF have added another micro-based system to their 7100 series. The new 7130 is specifically for applications where large storage capacity is needed. Fitted with up to 10 Mb of fixed disc storage in addition to twin mini floppies the system can run Extended Business BASIC, COBOL and Assembler as well as a number of supplied utility programs. Further information from Paul Raggett at BASF Computers, 4 Fitzroy Square, London W1P 6ER or ring him on 01-388 4200.

MEDIA UPDATE

Petalect are now offering a range of diskettes, ribbons and paper for micro-based systems. Verbatim or Nashua branded 5¼" discs will set you back £25.50 per 10, paper is £16 per 2,000 sheets and ribbons for the Commodore 4022 printer are £3.45 each. Many other items are available and prices and details can be obtained from Petalect at 33-35 Portugal Road, Woking, Surrey GU21 5JE. You can telephone on Woking 69032 or drop into their showroom at 32 Chertsey Road in Woking.

COR STOR?

Keen Computers are now offering the latest Corvus hard disc unit for Apple users. The new 5Mb drives are compatible with both the Apple II and III and complement the existing 10 and 20Mb versions. Disc backup is possible with the MIRROR video tape system and up to 64 systems can share the same disc using the CONSTELLATION networker. Control is handled by a supplied Z80 based card and up to three other drives of either size may be added. As an added bonus 12 utility programs are supplied with the discs. For pricing and further information contact Keen Computers at Minerva House, Spaniel Row, Nottingham or ring on 0602-412777.

CAT UPDATE

Inmac have just published their latest catalogue of supplies for mini and microcomputer users. As well as listing all the previous categories they have extended their range by some 50 new items. The theme of the catalogue is 'Protect Your Data' and they show some 20 ways you can guard against data loss. Copies of the catalogue are free and to get yourself on the mailing list drop a line to Dept P10, Inmac UK Ltd, 18 Goddard Road, Astmoor Industrial Estate, Runcorn, Cheshire WA7 1QF. All prices quoted in the catalogue will be maintained until November 1st when the next issue will be published.

SIG NET GOES APL

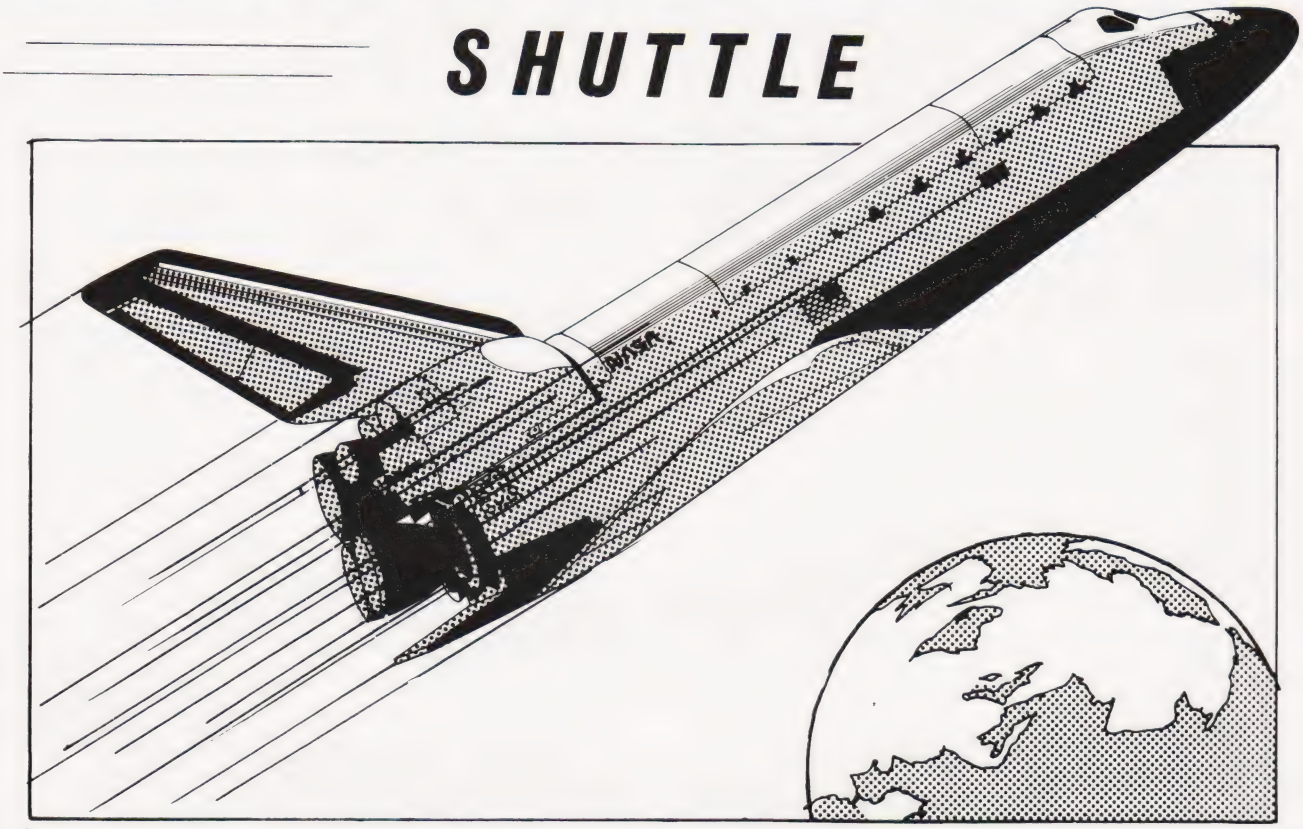
A low-cost entry point into APL programming is being offered by MicroAPL who are using the Shelton SIG NET computer. Based on a Z80A CPU with 64K of RAM, twin 5¼" discs giving 380K of storage and two RS232 serial ports it features MicroAPL running under CP/M 2.2 and a self-teaching package. Adding an APL VDU and printer will still leave you some change from £3,500. To add to the attractiveness of the system they are also selling software packages at £200 and up: buy four and they'll throw in a fifth free. To find out more about this package deal contact MicroAPL at 19 Catherine Place, Victoria, London SW1E 6DX or give them a ring on 01-834 2687.

VISUAL OBSERVATIONS

Anderson Jacobson are bringing out a new 15" VDU designated the AJ 520. Ergonomically designed, it features a detachable keyboard, user programmability and 132 column display capacity. Because of the large screen, characters are still 50% larger than usual at 132 column size. The terminal includes a 5K buffer which uses memory management techniques to allow more pages of storage — this can be expanded to 21K. To further enhance the memory capacity a 5¼" disc can be attached allowing 204K of off-line storage. The unit is VT-100 and VT-52 compatible and a full technical spec can be obtained from Anderson Jacobson at 752 Deal Avenue, Slough, Berkshire SL1 4SJ.

INNOVATIVE
TRS-80 SOFTWARE
FROM THE PROFESSIONALS

SHUTTLE



This program is a highly accurate computer simulation of the flight of the Space Shuttle Columbia from the initial countdown through the launch period, the launch itself and into a stable orbit. The craft may be manoeuvred within the orbit and then dropped out to finally fly through the atmosphere to a safe touchdown.

The attraction of this simulation is its authenticity. So far as is possible, it follows the actual parameters of the first Columbia flight with only one or two minor exceptions. The shuttle, of course, starts its flight pointed vertically into the sky and carries a huge fuel tank to provide the fuel for its three main engines in addition to the solid fuel rockets which provide the major thrust to lift it off the ground. Two minutes into the flight the rockets are jettisoned, having burned all their fuel. The count-down for take off starts at T-20 seconds. At T-10 seconds the shuttle motors start firing, but the shuttle remains tethered until T = 0. When the shuttle blasts off, the pilot must guide the craft into its orbit by controlling its attitude and track. A number of guidance controls are supplied, together, of course, with control of the shuttle motors' thrust.

The simulation may be started at one of three points in time: either at take off, at a point where the Columbia is in a stable orbit round the earth, or finally, prior to landing. Measurements of speed, fuel and so on may be selected for either Metric or Imperial measurements. All of the physical forces which acted upon the actual flight are taken into account. One departure from fact has been included in that the two solid fuel rockets have had their thrusts increased from 26 to 36 million Newtons so as to give the pilot an increased latitude for error. In other words to make the take off easier.

A fascinating program, the more so because it follows fact so closely. Available for the Model I and Model III TRS 80, Model I and Model II Genie and on tape or disk. The tape version will run in 16K, the disk in 32K.

Tape version.....**£14.95** Disk version.....**£17.95**

Both inclusive of V.A.T. but plus 50p P & P (if ordered alone).

TRS-80 & VIDEO GENIE SOFTWARE CATALOGUE £1.00 [**refundable**] plus 50p postage.

MOLIMERX LTD.

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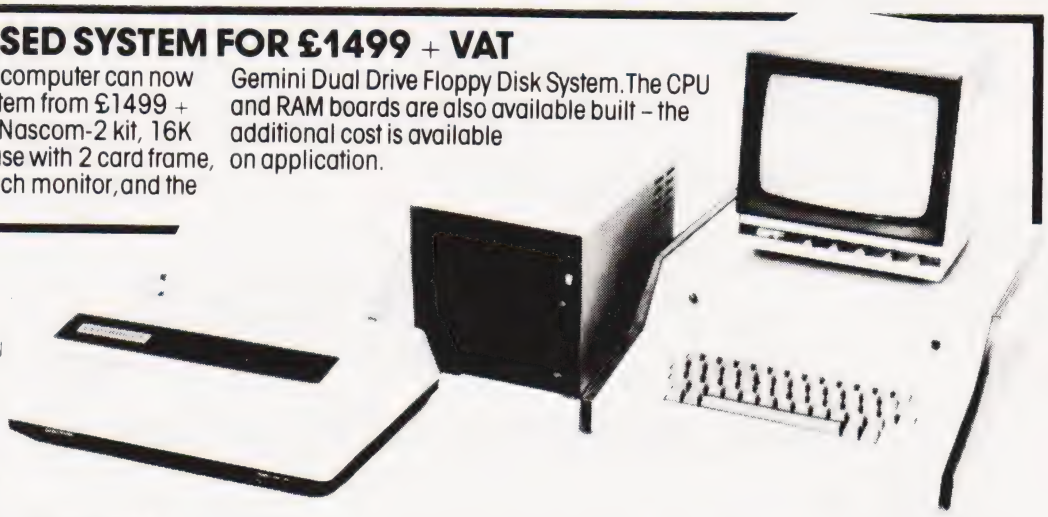

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D-DOS SYSTEM. The disk unit is also available without CP/M to enable existing Nas-Sys software to be used. Simple read, write routines are supplied in EPROM. The unit plugs straight into the Nascom PIO.

Single drive system . . . . . **£395 + VAT**
(please state which Nascom the unit is for)

Certain parts of the CP/M and D-DOS disk systems are available in kit form.
Details available on request.

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The Kenilworth case is a professional case designed specifically for the Nascom-2 and up to four additional 8" x 8" cards. It has hardwood side panels and a plastic coated steel base and cover. A fully cut back panel will accept a fan, UHF and video connectors and up to 8 D-type connectors. The basic case accepts the N2 board, PSU and keyboard. Optional support kits are available for 2 and 5 card expansion.

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The Nasbus compatible EPROM board accepts up to 16,2716 or 16,2708 EPROMs. It has a separate socket for the MK36271 8K BASIC ROM for the benefit of Nascom-1 users. And for Nascom-2 users, a wait state for slower EPROMs. The board also supports the Nascom Page Mode Scheme.

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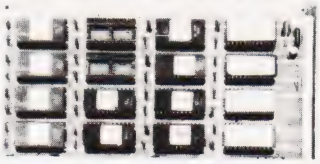

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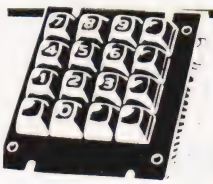

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NASCOM 1 & 2

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"MICRO-POWER" - Magazine

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Alan Stokes

THE TEACHER'S TALE

We open our new spot for educationalists with a short story that could easily be fact rather than fiction

Pearson staggered into the staff room and dumped 38 ragged exercise books, and 35 crumbling text books onto the table. The table rocked, despite the copy of "The Programmed Learning Revolution" wedged under one leg, and flipped the ash tray into Miss Witheridge's lap. Disgruntled mutterings issued forth with the No 6 smoke from behind bridge hands, as Pearson waded through the haze to the electric kettle. Coffee at last!

Miss Witheridge watched Pearson discover that the kettle was empty, watched him fill it and discover it wasn't working. "Fuse again", she announced. She watched him cross the room and rattle a drawer before adding, "Fuse drawer's locked. Caretaker's off sick".

Pearson slumped into a chair to begin marking. If he survived 3H1 after break he was on the home run to lunchtime, but not if it was anything like this morning! He ruminated on the high rate of nervous breakdowns amongst teachers . . .

Pearson had not had one of his better mornings. 3H3 had been in room 12 when he'd arrived after first period. Someone had sent them in as they were blocking the corridor while the rest of the school was trying to swirl its way to period two.

First period he had taken 2L2 in "The Hut". The overhead projector slides which he'd spent the previous evening preparing had been useless. "The Hut" had no power points. (Pearson's usual Wednesday period one room had been commandeered for 5L2s' Anti-smoking film). Room 12 was on the far side of the school, and of course the bell that gave the coup de grace to period one was also the starting pistol for period two. No interlude.

And so it was that Pearson finally arrived at room 12, turned down the volume, banished the make-up, and subdued the soccer crowd, before discovering that someone had wiped out the prerecorded tape he had set up in his own time before Assembly. Pearson's baleful gaze settled on Ellis. 'Weren't me sir!" It was, though, but Ellis was a bona fide problem child. No dad. Visited the educational psychologist. There'd been a memo round: disturbed child — no punishments. Ellis was unsinkable.

Pearson tried to write on the whiteboard, but the marker had dried up. No-one knew why one day all the blackboards had gone and the hated whiteboards had appeared. No-one had asked the teachers what they wanted.

He had sent Tracie to Miss Witheridge to borrow a marker and she had come back saying Miss Witheridge's marker had dried up, and did he know where the spare bulb for the projector in the language lab could be found?

He had to occupy the 35 fourteen year olds for the remainder of the 35 minute period as best he could. He'd hoped to update the accounts for the school shop while they had been listening to the tape.

Pearson paused in his marking, and looked at the fustian textbooks on the end of the bridge table. At least if the shop continued to flog sticky buns at the present rate there'd be enough money by the end of term to get new books for 3H3 and theirs could go to 3H1 who hadn't got any.

Pearson's attention was caught by Miss Witheridge, who was telling a story.

". . . And over my earphones I could hear one say to the other, it's gone wrong again Kev, we can talk to each other and Witless can't hear us. I shouted down the mike that I damn well could. But they couldn't hear me. I had to charge into the class and rip their earphones off . . ."

Just then there was a minor detonation and a shower of stardust. An intellectual fellow of well-meaning demeanor stepped forward and announced: "I am your Fairy Techno-Wizard. Ask of me what you wish!" A stunned staff room found its voice again. "More preparation time!" "Decent wages!" "Ancillary helpers!" "More accommodation!" "Smaller classes!"

"You dyed-in-the-wool conservatives, you! Don't you know there's a revolution going on? What you need is . . ."

And SHAZAM! a microcomputer appeared, squat and smug on the bridge table.

As the ozone cleared a faint gibbering could be heard. Pearson had finally broken.

computing today

OCTOBER 1981
ISSN 0142-7210
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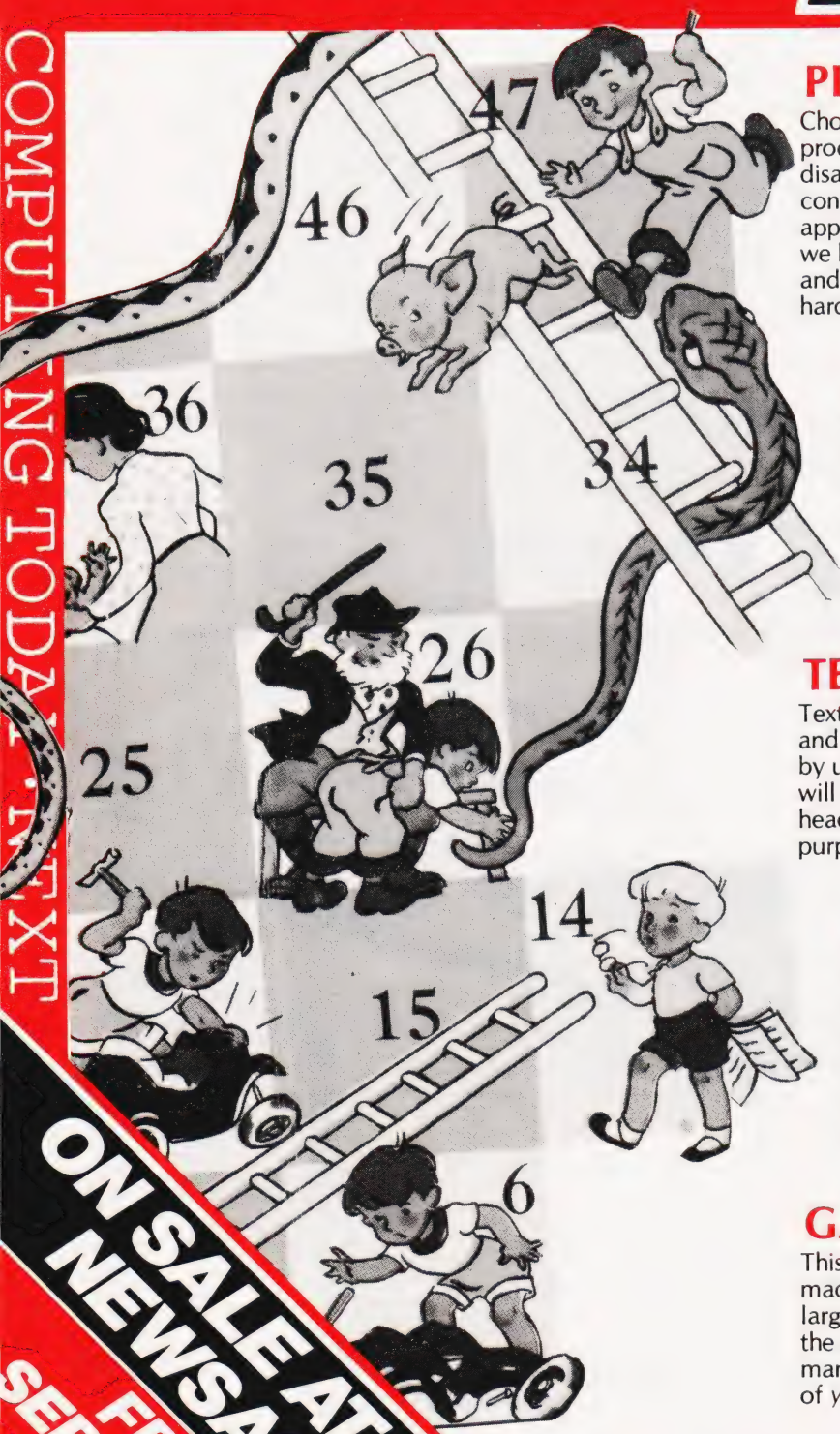

PLAYING THE SYSTEMS GAME

Choosing a system nowadays is a complex and intricate process where a single mistake can lead to financial disaster. It matters little whether the system you are considering costs £100 or £1,000: the same principles apply. To assist you in your first steps to micro ownership we have compiled a major feature on the pitfalls to avoid and the questions you should ask before parting with that hard-earned cash.

UPGRADE YOUR BASIC

The phrase 'structured programming' is on everybody's lips these days, but few people seem to realise that they can incorporate the necessary routines into their own versions of BASIC. One particular implementation, Crystal BASIC, even encourages the user to enhance it and, using information that is readily available, we show you how it's done.

TEXT STORAGE PROBLEMS

Text always seems to take up a large amount of memory, and there are ways to substantially reduce this overhead by using some clever routines. In next month's issue we will be showing you how to reduce your memory headaches and developing a set of routines for just this purpose.

ATOMIC TECHNIQUES

While the Acorn ATOM has been criticised for its apparently non-standard version of BASIC it does have considerable potential. Getting the most out of your system really depends on using the right techniques and, in the first of an occasional series on small systems, we outline the kind of problems you may encounter and the ways round them.

GAMING GAINS

This month we showed you how predictions could be made on the outcome of football matches by using a large data base of recent results. Next month we present the software that handles all the data base generation and manipulation. Get onto a winning streak by making sure of *your* copy of our October issue!

Articles described here are in an advanced state of preparation but circumstances may dictate changes to the final contents.

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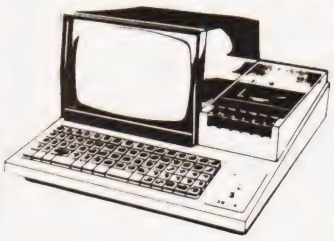

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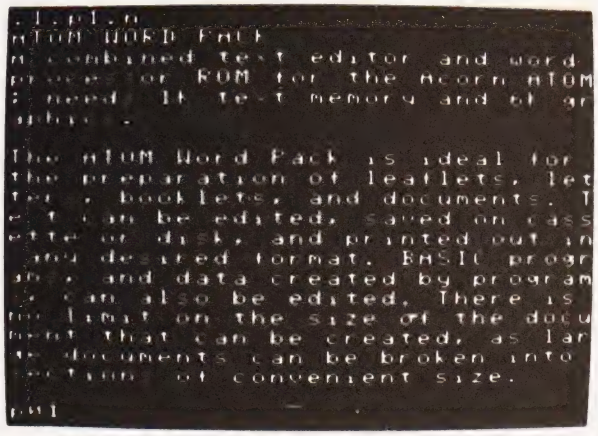

The ATOM word pack is ideal for the preparation of leaflets, letters, booklets and documents. Text can be edited, saved on cassette or disk and then printed out in any desired format. BASIC programs and data created by programs can also be edited. The Word Pack is a 4K ROM which simply plugs into the ATOM's utility ROM socket and adds EDIT and TEXT to the command set. Complete with a 16 page booklet giving full instructions and examples. Just £29.90 including post, packing and insurance.

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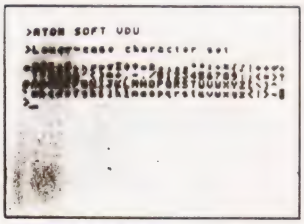

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Simultaneous Solves a set of simultaneous equations, with integer or real coefficients. Program 2K, graphics ½K.
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UTILITY PACK 1
Disassembler Lists machine code in standard ATOM assembler form, or stores the assembler text into memory. Graphics 2K.
Fast Cos Modifies the ATOM's standard cassette-interface routines to operate at 1200 baud, or 4 times faster. Program 1K.
Renumber A fast renumber for BASIC or assembler programs, gives display of the numbers for labelled lines. Program 1K.

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7401	12p
7402	12p
7403	14p
7404	14p
7405	18p
7406	30p
7407	30p
7408	16p
7409	16p
7410	15p
7411	20p
7412	20p
7413	30p
7414	40p
74C14	90p
7416	27p
7417	27p
7420	17p
7421	30p
7422	22p
7423	25p
7425	30p
7426	30p
7427	30p
7428	30p
7430	17p
7432	30p
7433	30p
7437	30p
7438	30p
7440	17p
7441	70p
7442A	50p
7443	112p
7444	112p
7445	80p
7446A	93p
7447A	60p
7448	80p
7450	17p
7451	17p
7453	17p
7454	17p
7460	17p
7470	36p
7472	30p
7473	32p
7474	30p
7475	38p
7476	32p
7480	50p
7481	100p
7482	84p
7483a	60p
7484	100p
7485	110p
7486	30p
7489	210p
7490A	30p
7491	80p
7492A	40p
7493A	30p
7494	84p
7495A	60p
7496	50p
7497	180p
74100	100p
74107	34p
74109	55p
74116	100p
74118	100p
74119	100p
74120	110p
74121	34p
74122	48p
74123	60p
74125	60p
74126	60p
74128	60p
74132	60p
74136	60p
74137	50p
74141	75p
74142	200p
74145	90p
74147	120p
74148	100p
74150	120p
74151A	50p
74153	50p
74154	90p
74155	60p
74156	60p
74157	50p
74159	120p
74160	70p
74161	70p
74162	70p
74163	70p
74164	90p
74165	90p
74166	90p
74167	200p
74170	200p
74172	300p
74173	90p
74174	75p
74175	75p
74176	70p
74177	90p
74178	100p
74180	80p
74181	160p
74182	90p
74184A	120p
74185	120p
74186	500p
74188	325p
74190	90p
74191	90p
74192	90p
74193	90p
74194	90p
74195	95p
74196	95p
74197	80p
74198	120p
74199	120p
74221	90p
74251	100p
74259	120p
74278	200p
74279	110p
74283	140p
74284	250p
74285	250p
74290	100p
74293	100p
74298	100p
74365	60p
74366	60p
74367	60p
74368	60p
74390	100p
74393	120p
74490	150p

74LS SERIES

74LS00	14p
74LS02	14p
74LS03	14p
74LS04	16p
74LS05	20p
74LS08	20p
74LS09	20p
74LS10	20p
74LS11	25p
74LS12	30p
74LS13	30p
74LS14	50p
74LS20	20p
74LS21	25p
74LS22	27p
74LS26	30p
74LS27	30p
74LS30	20p
74LS32	27p
74LS33	27p
74LS37	30p
74LS38	30p
74LS40	25p
74LS42	60p
74LS47	60p
74LS51	24p
74LS55	30p
74LS73	40p
74LS74	27p
74LS75	36p
74LS76	45p
74LS83	70p
74LS85	80p
74LS86	40p
74LS90	40p
74LS92	70p
74LS93	50p
74LS96	110p
74LS107	45p
74LS109	60p
74LS112	40p
74LS113	90p
74LS114	45p
74LS122	80p
74LS123	60p
74LS124	180p
74LS125	45p
74LS126	45p
74LS132	60p
74LS133	45p
74LS136	40p
74LS138	55p
74LS139	55p
74LS145	120p
74LS147	160p
74LS148	140p
74LS151	70p
74LS153	60p
74LS154	200p
74LS155	60p
74LS156	60p
74LS157	50p
74LS158	60p
74LS160	75p
74LS161	75p
74LS162	75p
74LS163	60p
74LS164	75p
74LS165	100p
74LS166	120p
74LS173	110p
74LS174	80p
74LS175	75p
74LS181	200p
74LS190	75p
74LS191	75p
74LS192	75p
74LS193	75p
74LS194	90p
74LS195	90p
74LS196	90p
74LS197	90p
74LS221	90p
74LS240	120p
74LS241	120p
74LS242	90p
74LS243	90p
74LS244	100p
74LS245	120p
74LS247	140p
74LS251	75p
74LS253	75p
74LS257	75p
74LS258	75p
74LS259	100p
74LS266	50p
74LS273	120p
74LS279	75p
74LS283	75p
74LS298	100p
74LS299	375p
74LS323	250p
74LS324	150p
74LS348	200p
74LS365	48p
74LS367	50p
74LS368	50p
74LS373	120p
74LS374	120p
74LS375	60p
74LS377	100p
74LS378	80p
74LS390	90p
74LS393	90p
74LS399	120p
74LS445	140p
74LS540	250p
74LS541	300p
74LS640	300p
74LS641	300p
74LS642	300p
74LS643	300p
74LS644	300p
74LS668	100p
74LS670	225p

74S SERIES

74S00	60p
74S02	60p
74S04	60p
74S05	75p
74S08	75p
74S10	60p
74S20	60p
74S30	60p
74S32	90p
74S37	90p
74S64	60p
74S74	90p
74S85	300p
74S86	180p
74S112	120p
74S114	120p
74S124	300p
74S132	160p
74S133	75p
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75365	150p
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75491/2	70p
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8T28	160p
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1.008MHz	350p
1.8432MHz	250p
2.00MHz	250p
2.45760MHz	250p
3.276MHz	250p
3.579MHz	175p
4.00MHz	200p
4.194MHz	250p
4.43MHz	125p
5.0MHz	250p
6.0MHz	250p
6.144MHz	250p
7.0MHz	250p
7.168MHz	250p
8.00MHz	250p
8.867MHz	250p
10.00MHz	250p
10.0MHz	250p
12.0MHz	300p
16.00MHz	300p
18.0MHz	250p
18.432MHz	250p
19.968MHz	390p
20.00MHz	250p
22.118MHz	250p
24.00MHz	350p
32.0MHz	300p
50.0MHz	400p
100.0MHz	350p

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GETTING INTO PRINT

Don Thomasson

Connecting a printer to a computer is not always made easier by the presence of a 'standard' interface

You have a computer. You buy a printer and plug it in. Switch on, and you can print what you like. True or false? Well, we shall say the statement is rather oversimplified. The following notes, although they deal specifically with the combination of a Sorcerer computer and an Epson MX80 printer, should serve to draw attention to the sort of problems that are likely to arise.

First, there is the little matter of choosing a printer from the wide range of available makes and types. Compromise is necessary here. Silence of operation must be balanced against durability of printout to the lower half of the full is more noisy the results are less likely to fade or discolour with the passing of time. Cost must be balanced against print quality. If you can afford a daisy-wheel machine you will get more professional-looking results, but some matrix printers can produce an adequate type-face for most purposes. There is also the question of interface compatibility between printer and computer to be taken into account. In some cases, there may be a significant increase in cost involved in matching up interfaces which are almost, but not quite, compatible.

Industry Standards

The printer interface most commonly quoted is the 'Centronics', but it has variations. The Sorcerer provides a 'Centronics' interface which handles only seven data bits, the eighth being used as a strobe. Using this interface would limit printout to the lower half of the full ASCII code range. Fortunately, there is an alternative interface, covering eight data bits. Both interfaces use the same connector, but the driving routines are different.

Listing 1 shows the routine for the 'Centronics' interface. The Video routine is first called to put the character defined by the A register contents on to the screen. Now, the Video routine responds to CHR$(13), carriage return, by setting the cursor column counter to 0, but it does not move to the next line. CHR$(10), line feed, is therefore generated after carriage return, and this moves the cursor down a line and, if necessary, calls the scrolling routine.

A printer usually has no need for the line feed, the line advance being automatic, and the 'Centronics' routine therefore suppresses the line feed by the jump to BB2. If the suppression is not wanted, it can be avoided by entering the routine at E99B. Entry must be by a jump from a subroutine, and AF must be pushed just before the jump to balance the pop at E9AF.

The rest of the routine is mainly concerned with port 255 (FF), which handles parallel data transactions. Input bit 7 is checked, this being connected to the Busy line from the printer. If the printer is busy, bit 7 is true, and the routine loops

```
E993  F5           PUSH AF
E994  CD 1B E0     CALL E01B      VIDEO
E997  FE 0A        CP,10          Line Feed?
E999  28 14        JR Z,+22       BB2
E99B  F5           PUSH AF
E99C  DB FF   BB1  IN A,(255)     Check Busy
E99E  CB 7F        BIT A,7
E9A0  20 FA        JR NZ,-4       BB1
E9A2  F1           POP AF
E9A3  F6 80        OR 128         Insert bit 7
E9A5  D3 FF        OUT (255),A
E9A7  E6 7F        AND 127        Zero bit 7
E9A9  D3 FF        OUT (255),A
E8AB  F6 80        OR 128         Insert bit 7
E9AD  D3 FF        OUT (255),A
E9AF  F1      BB2  POP AF
E9B0  C9           RETURN
```

Listing 1 Centronics Routine

```
E77F  F5           PUSH AF
E780  DB FE   AW1  IN A, (254)    Check busy state
E782  CB 77        BIT A,6
E784  28 FA        JR Z, -4       AW1
E786  F1           POP AF
E787  D3 FF        OUT (255),A
E789  C9           RETURN
```

Listing 2 PARLOT Routine

until the Busy state ends and the bit is zero. The contents of A are then passed to the printer three times, first with bit 7=1, then with bit 7=0, then with bit 7=1 again. This generates the data strobe on output bit 7, instructing the printer to take the data.

The alternative PARLOT routine is shown in Listing 2. It is much simpler, paying no attention to the deletion of line feeds, merely checking the state of bit 6 of input port 254 (FE) and passing all eight bits of the contents of A to output port 255 when bit 6 is zero. The handshake control is effected by a bistable which is set whenever an output is passed to the printer, and reset when the printer is ready for a further transfer, shown by generation of the Acknowledge signal.

In practice, the output of either interface is only likely to be delayed while the printer is actually printing. For maximum speed, the driving routine should therefore be arranged to assemble a line of data and output it in one burst, rather than sending it to the printer in dribs and drabs. For example, in a disassembler program originally written for output to the VDU, the various elements forming an output line were passed to the screen as they were generated. With the printer in use as an output device, it was found better to assemble the line by statements of the form A$ = A$ + B$, finally putting out the whole line by PRINT A$.

There is no need to opt definitely for either of the two possible interfaces. The connection diagram in Fig.1 shows how a DPCO switch can be included in the connection cable, preferably in a small box, to allow selection of either interface. The only disadvantage of this is the need to remember to alter the switch to suit the program in current use. Without the switch, however, there could be problems.

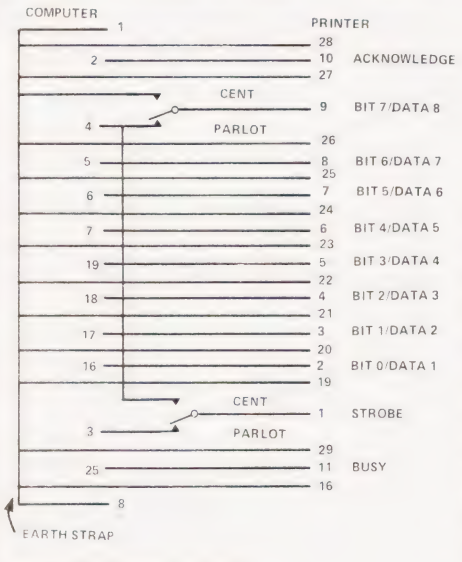

Fig. 1 The connection diagram for the printer/computer interface.

Since the MX80 graphics are in the upper half of the ASCII table, they are inaccessible with the seven-bit interface in use. So are the alternative control characters, which may be useful to avoid clashes between the response of the printer and the response of the computer. CHR$(15) selects condensed print on the MX80, but is a disable code in Sorcerer BASIC, and is also output as a printer disable code by the Word Processor ROMPAC. It may therefore be convenient to use CHR$(143) = Graphics/W to select condensed print. This is only posible with the PARLOT interface.

However, if the word Processor ROMPAC is in use, the Centronics interface is mandatory, the relevant routine being in the ROM. There are ways of bringing the PARLOT interface into action by adding extra code in RAM, which must be entered after a cold start, but these need a comprehensive knowledge of the Word Processor routines which would be too complex to explain here.

Solving The BASIC Problem

A similar problem arises with Exidy Extended Cassette BASIC, but that is loaded from tape into RAM, so a simpler solution is possible. The original and revised routines are;

Original

```
1FBE  B7          OR A
1FBF  F2 C4 1F    JP P,1FC4
1FC2  3E 3F       LD A,63
1FC4  F5          PUSH AF
1FC5  C3 97 E9    JP U,E997
```

Revised

```
1FBE  B7          OR A
1FBF  F2 C4 1F    JP P,1FC4
1FC2  00 00       NOP
1FC4  F5          PUSH AF
1FC5  C3 80 E7    JP U,E780
```

The original routine inserts '?' when the contents of A relate to a code in the upper half of the ASCII range. The jump has been left in place to allow a modifying instruction to be inserted in place of the two NOPs. For example, C6 20 adds 32 to the ASCII value, moving the lower half of the Sorcerer Graphics range up to match the MX80 graphics area. The Extended BASIC covers LLIST, LPRINT and LPRINT USING, all providing direct output to the printer, so it would be a pity to suffer a limitation to the available range of print codes.

Quite apart from these special cases, the introduction of the printing function into ordinary BASIC programs can be troublesome. The L-prefaced instructions are not available, so it is necessary to switch to the printer output by other means. The Sorcerer has a common SEND routine used for all output functions, and this calls the particular output function indicated by an entry link set in the Monitor RAM, at locations 63 and 64. The position of these locations varies according to the amount of RAM in use, but can be found by subtracting 110 from the address of the highest available RAM location and adding 63 and 64 respectively. This also covers a case where the Monitor RAM and stack have been relocated by the user, the process defining an artificial 'top of RAM' above which machine codes can safely be entered.

Noting that location 63 contains the low byte and 64 the high byte, according to the usual 8080/Z80 convention, the relevant links are;

	Indirect	Direct
VIDEO	E01B	E9F0
PARLOT	E021	E7FF
CENTRONICS	— —	E993

The indirect links are in a switch area at the start of the Monitor program, and are unconditional jumps to the direct links. It should be noted that only the normal routine starts are accessible by these links.

During cold start, the link E9F0 is set. Other links can be set by use of the Monitor SET O= command, but these are all indirect links, except in the case of CENTRONICS, which only has a direct link. Now, it is more convenient to be able to set new links without visiting the Monitor, and it has been suggested that this can be done by POKEing into the link locations directly. It can, but extreme care is needed. For example, suppose the link is E9F0, and an attempt is made to set it to E021. Location 63 is set to 21 by the first POKE, and the link is now E921. This is a location in the Test routine, and before the second POKE can take effect the test routine goes into action. It is therefore only possible to switch between E993 and E9F0, or between E01B and E021, one byte of the link being changed. Life is sometimes so complicated!

A safer and more flexible method of switching the links is to use a small machine code subroutine, to which a selection code is passed. A useful machine code routine is;

```
0000  3A C2 01   LD A,(01C2)
0003  CD 9F D6   CALL D69F      *BF for 48K
0006  21 0B 00   LD HL,000B      7F for 32K
0009  19         ADD HL,DE       3F for 16K
000A  E9         JU(HL)
```

```
000B  21 1B E0   LD HL,E01B (Video Link)
000E  22 D0 *    LD (* D0),HL
0011  C9         RETURN
0012  21 21 E0   LD HL,E021 (Parlot Link)
0015  18 F7      JR U - 7
0017  21 93 E9   LD HL,E993 (Centronics
001A  18 F2      JR U - 12 Link)
```

And then, in BASIC

POKE 260,0:POKE 261,0

To call Video, Z=USR(0)
To call Parlot, Z=USR(7)
To call Centronics, Z=USR(12)

The D69F routine puts the integer value of the bracketed number in DE: this is added to HL to determine which of the three dependent routines is entered, and therefore which link is set.

Using The System

Having made up the connection cable and decided on the routines to be used, it will be possible for you to produce hard copy — of a kind. You may have no objection to the LIST and READY prompts topping and tailing your listings, but in other cases you will want to separate the real text from such intrusions. This rather depends on what you want to do with your printer. If you use a word processor or Extended BASIC, you will have little to worry about. If you want to work in machine code or Standard BASIC, you may have further problems.

One of the more useful capabilities of the MX80 is the control of the printer by select and deselect, though the description in the User's Manual has more than a touch of Oriental subtlety. To use this facility, the SLCT IN input to the printer must be high, so DIP switch 1/8 must be off. Code DC1 (CHR$(17)) will then enable the printer, and Code DC3 (CHR$(19)) will disable it. (These happen to be the Cursor Home and Cursor Right codes for the Sorcerer, so they need to be generated in the CHR$ form.) The important point is that the printer, when disabled, will still accept and acknowledge data — it has to, in order to detect the enable code — so the handshake is not blocked, as it is when the printer is switched off line.

Once this stage of 'working up' has been reached, progress should become reasonably smooth, but there can still be surprises. Repeated form feeds were traced to a horizontal graphics character which had the same code — CHR$(140) — as the upper Form Feed code of the MX80. The rather fiendish hooter which is the MX80 equivalent of a bell was also brought into action by a graphic, this time CHR$(135), a vertical line.

Users of the Sorcerer Toolkit should be aware that it is not compatible with printed output, as it uses its own output routine and insists on talking to the screen. If there is a way round this, it would be nice to know.

Sadly, there is no way to make the basic MX80 reproduce the delicate Sorcerer graphics, which have 64 defined points per character. The MX80 TRS-type graphics have 6 pixels per character, and that is a wide gulf. There is hope that the problem can be solved by the use of a 'frame grabber', which takes a screenful of information at a gulp, and can re-issue it at a more sober pace, but until we have one it would be rash to comment.

The warnings and complexities of the above could be taken to mean that the Sorcerer and the MX80 form an uneasy combination. Not so. The reverse is true. The flexibility of both devices is rather above average, and that means that a little more care can, and must, be taken to get the best results.

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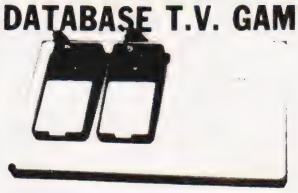

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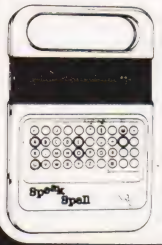

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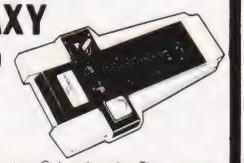

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The only machine-dependent instruction is the Reset at the end, so it should be possible to convert it to other Z80 machines, especially those running Microsoft BASIC. Obviously, in this case the start location would have to be changed, and the tokens checked and changed if necessary.

What It Does

The program starts at the first BASIC address, and goes through the program stripping out all REMs and spaces between program statements while leaving the spaces in PRINT and INPUT strings.

How good is it? I have used it on all my programs, and have achieved savings of 87 bytes for a short program and 1736 bytes on a 17K Startrek. 87 bytes is neither here nor there, but 1736 bytes is not to be sneezed at!

BASICally Speaking

To understand how the program works, we must first consider how the BASIC program is stored in memory. (Those of you familiar with this can skip the next bit.)

The top address of the program is stored in 10D6H and 10D7H. The first program line starts at 10FAH. The lines are organised as two bytes holding the address of the start of the next line, two bytes holding the line number, and then the line itself, terminated by a zero byte. The BASIC uses codes 80H to CFH as reserved words. Thus, the program

```
10 PRINT"PRINT THIS"
20 X=1: Y=2
30 END
```

appears in memory as

```
10FA 0C 11 0A 00 9E 22 50 52 49 4E 54 20 54 48 49 53 22 00
110C 18 11 14 00 58 B4 31 3A 59 B4 32 00
1118 1E 11 1E 00 80 00
111E 00 00
```

the last 00 00 being the 'end of program' token.

How It Does It

HL is pointed to the next byte to be tested. DE points to the next free location in the 'new' program. BC points to the last next-line address. Each byte is loaded and tested in turn. If it is found to be 20H, the code for a space, and it is not in a string, then HL is incremented without loading the byte in the new program, thus disposing of it effectively.

If the byte is 22H, the code for inverted commas, then the program knows that it has arrived at the start of a string, so jumps to a routine that picks up the next byte and puts it straight into the new program. This saves all the spaces in strings. It keeps on doing this until it finds the closing inverted commas, when it jumps back to the main loop.

If the byte is 00H, the code for the end of a line, it jumps to a routine that puts the address of the next line in the last next line location. (You might have to read that a couple of times before you understand it. I had to, and I wrote it!) BC is then pointed to the new next-line location, and HL and DE are incremented to leave those two bytes free. A test is then performed to see if the end of the program has been reached. If it has not, it jumps back to the main loop. If it has reached the end, then it jumps to another routine that puts the double zero end of program token in, then loads the new address in the 'Top of Program' pointers. This routine ends the program with a return to NAS-SYS. In the BASIC program, address 0F80H has been changed to C9H, to return control to the BASIC.

If the byte is 8EH, the code for a REM, then the program jumps to a routine which deletes everything it finds until it finds the end of the line. It then goes back to the start of that line, and tests to see if this was 3AH, the code for a colon. If it was a colon, then the REM was tagged onto a line containing program statements, so it puts zero at the end and leaves it alone. If it was not a colon, then the REM was a line on its own, and the line number can be deleted as well.

How To Use It

Personally, I write and develop my programs with spaces and explanatory REMs as usual. This helps a lot when debugging a new program. I then SAVE this as my back-up copy (you do all keep back-up copies, don't you?). I then run the compactor through the program, and SAVE this as my working copy.

This means that I gain all the advantages of speed and compactness where I need them, but that I still have a commented, expanded version should program development ever be required. Alternatively you could load the program into memory, and use it after LOADing each program.

The machine code version is executed from 0F00, or wherever you have sited it. The BASIC version is called by DOKE 4100, 3840:X=USR(0), but only in command mode.

Things To Watch For

If you use REMs as a target for GOTOs or GOSUBs then the program will crash when you run it, because all the REMs and their line numbers have been deleted!

If you READ strings from DATA statements, and do not delimit them with inverted commas, then the program will delete all the spaces in them and you'll have to go and put them all back!

Program Listing

```
65325   FOR X=3840 TO 3968 STEP 2:READ  Y
65326   DOKE X,Y:NEXT
65327   DATA  -1503, -6896,9153,8995, -6877,32465
65328   DATA 8446,3624,8958,3368,254,13864
65329   DATA  -28930,3880,4882,6179,4842,8979, -386
65330   DATA 10274,6387, -14858, -6699, -7719, -15919
65331   DATA 32291,254,552, -2024,11225, -386,8250
65332   DATA  -20731,7129, -12776,9177,8995,6939
65333   DATA 5144,4882,635,31235, -11006,9153
65334   DATA 8995, -10694, -17136,2344,4883,4734
65335   DATA 4899,6270,15027,4311,8380, -20495
65336   DATA 4882,4882,21485,4310,21485,4312
65337   DATA 21485,4314,201
```

This BASIC program contains all the machine code of the listing below.

```
INITIALISATION
0F00  21 FA 10   LD HL, 10FA   START OF FIRST BASIC LINE
0F03  E5         PUSH HL       SAVE THE START
0F04  C1         POP BC        LOCATION IN BC
0F05  23         INC HL        ADD 4 TO HL
0F06  23         INC HL        TO PASS OVER THE
0F07  23         INC HL        NEXT LINE AND
0F08  23         INC HL        LINE No LOCATIONS
0F09  E5         PUSH HL       LOAD FIRST PROGRAM
0F0A  D1         POP DE        LOCATION INTO DE

MAIN LOOP
0F0B  7E         LD A, (HL)    GET NEXT BYTE
0F0C  FE 20      CP 20         IS IT A SPACE?
0F0E  28 0E      JR Z 0EH      YES - SO JUMP TO INC HL TO
                               LOSE IT
0F10  FE 22      CP 22         INVERTED COMMAS?
0F12  28 0D      JR Z 0DH      YES - IT'S A STRING - KEEP IT
0F14  FE 00      CP 00         END OF LINE?
0F16  28 36      JR Z 36H      YES - JUMP TO END OF LINE
                               ROUTINE
0F18  FE 8E      CP 8E         BASIC TOKEN FOR REM
0F1A  28 0F      JR Z 0FH      JUMP TO DELETE ROUTINE
0F1C  12         LD (DE), A    LOAD BYTE INTO NEXT PUT
                               LOCATION
0F1D  13         INC DE        POINT TO NEXT PUT
                               LOCATION
0F1E  23         INC HL        POINT TO NEXT TAKE
                               LOCATION
0F1F  18 EA      JR EAH        GO AND DO IT AGAIN

STRING ROUTINE
0F21  12         LD (DE), A    PART OF STRING - PUT IT
                               BACK
0F22  13         INC DE        NEXT PUT LOCATION
0F23  23         INC HL        NEXT TAKE LOCATION
0F24  7E         LD A, (HL)    TAKE NEXT BYTE
0F25  FE 22      CP 22         END OF STRING YET?
0F27  28 F3      JR Z F3H      YES - JUMP BACK TO MAIN
                               LOOP
0F29  18 F6      JR F6H        NO - JUMP BACK TO START
                               OF ROUTINE

REM DELETE
0F2B  C5         PUSH BC       SAVE THE
0F2C  D5         PUSH DE       REGISTERS AND
0F2D  E5         PUSH HL       EXCHANGE WITH
0F2E  D9         EXX           ALTERNATE REGISTERS
0F2F  E1         POP HL        RESTORE
0F30  D1         POP DE        THE
0F31  C1         POP BC        REGISTERS
0F32  23         INC HL        NEXT TAKE LOCATION
0F33  7E         LD A, (HL)    TAKE IT
0F34  FE 00      CP 00         END OF LINE?
0F36  28 02      JR Z 02H      YES - GO ON TO NEXT BIT
0F38  18 F8      JR F8H        NO - GO AND DO IT AGAIN
0F3A  D9         EXX           RECALL ORIGINAL
                               REGISTERS
0F3B  2B         DEC HL        POINT TO LAST BYTE BEFORE
                               REM TOKEN
0F3C  7E         LD A, (HL)    GET IT
0F3D  FE 3A      CP 3A         IS IT A ;
0F3F  20 05      JR NZ 05H     NO - GO DELETE LINE No AS
                               WELL
0F41  AF         XOR A         MAKE A=00
0F42  D9         EXX           RESTORE THE REGISTERS
0F43  1B         DEC DE        POINT DE AT ;;TO DELETE IT
0F44  18 CE      JR CEH        JUMP BACK TO MAIN LOOP
0F46  D9         EXX           RESTORE THE REGISTERS
0F47  23         INC HL        POINT HL
0F48  23         INC HL        AT START OF
0F49  23         INC HL        NEXT LINE NO
0F4A  1B         DEC DE        POINT DE TO START
0F4B  1B         DEC DE        OF LAST LINE NO
0F4C  18 14      JR 14H        JUMP TO LINE NO INSERTION

END OF LINE ROUTINE
0F4E  12         LD (DE), A    PLACE LAST BYTE
0F4F  13         INC DE        POINT TO NEXT
0F50  7B         LD A, E       LOW BYTE OF PRESENT
                               LOCATION
0F51  02         LD (BC), A    PUT IT IN NEXT LINE
                               LOCATION
0F52  03         INC BC        POINT TO HIGH BYTE
                               LOCATION
0F53  7A         LD A, D       HIGH BYTE OF PRESENT
                               LOCATION
0F54  02         LD (BC), A    PUT IT IN NEXT LINE
                               LOCATION
0F55  D5         PUSH DE       SAVE PRESENT LOCATION
0F56  C1         POP BC        NEXT LINE POINTER
0F57  23         INC HL        ADVANCE HL TO
0F58  23         INC HL        GET OVER THE PRESENT
0F59  23         INC HL        NEXTLINE LOCATION
0F5A  3A D6 10   LD A, (10D6)  LOAD A WITH LOW BYTE OF
                               TOP OF PROG
0F5D  BD         CP L          ARE WE THERE?
0F5E  28 09      JR Z 09H      YES - GO CHECK HIGH BYTE
0F60  13         INC DE        TO OVERCOME NEXT
0F61  13         INC DE        LINE LOCATION
0F62  7E         LD A, (HL)    LOW BYTE OF LINE NO
0F63  12         LD (DE), A    PUT IT IN THE PROPER PLACE
0F64  23         INC HL        MOVE EVERYTHING ALONG
0F65  13         INC DE        TO THE HIGH BYTE
0F66  7E         LD A, (HL)    GET IT
0F67  18 B3      JR B3H        JUMP BACK TO MAIN LOOP

END OF PROGRAM
0F69  3A D7 10   LD A, (10D7)  LOAD A WITH HIGH BYTE OF
                               TOP OF PROG
0F6C  BC         CP H          ARE WE THERE?
0F6D  20 F1      JR NZ F1H     NO - BACK TO MAIN LOOP
0F6F  AF         XOR A         CLEAR A
0F70  12         LD (DE), A    END OF PROGRAM TOKEN
0F71  13         INC DE        NEXT LOCATION
0F72  12         LD (DE), A    END OF PROGRAM TOKEN
0F73  13         INC DE        NEXT LOCATION
0F74  ED 53 D6 10  LD 10D6, DE POINT THE POINTERS
0F78  ED 53 D8 10  LD 10D8, DE TO THE TOP
0F7C  ED 53 DA 10  LD 10DA, DE OF NEW PROGRAM
0F80  DF 5B      MRET          RETURN TO NAS - SYS
```

This is the full machine code program for the compactor for those wishing to incorporate it into a utilities package.

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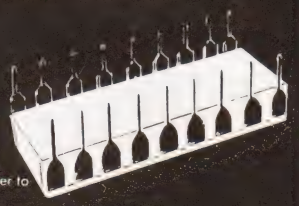

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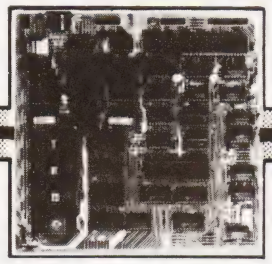

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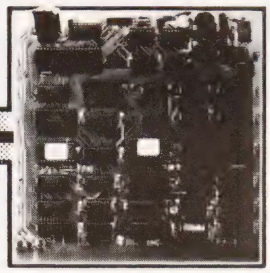

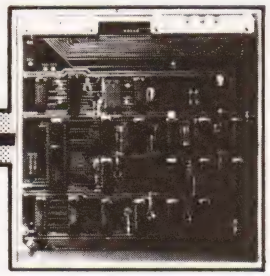

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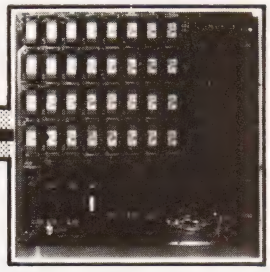

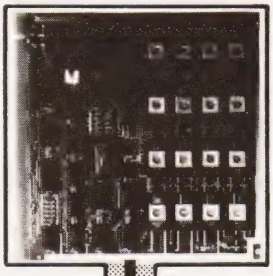

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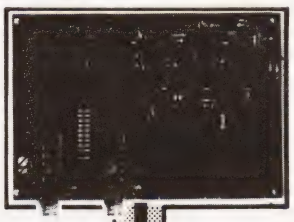

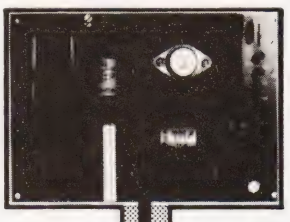

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- Connects to PIO on CPU board.
- Software provided on tape.

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- Supplies 4/5 boards.
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Simon Goodwin

Suitable for use in its own right or as a routine within a major Adventure game, this program should prove easily adaptable

In the last year there has been an upsurge of interest in microcomputer games of the 'Adventure' variety. In the field of detailing the environment in which adventures take place these computer games have been quite successful, but where they tend to fall down is in their system for simulating battles, a crucial part of many a dungeon campaign! This article describes a BASIC program that could be modified to simulate hand-to-hand combat in such games, and can also be fun in its own right.

Personality Profile

'Gladiators' is a game suitable for most microcomputer systems. The player has control over one gladiator, and the computer controls the other, in a fight to the death. Each combat is rated for strength, constitution and dexterity. Strength represents the ability of a gladiator to do substantial damage to his opponent (eg kill him) — the greater his strength, the more telling each blow will be. Constitution reflects general fitness and staying power; the amount of punishment a fighter can take before shuffling off this mortal coil to join his tribal ancestors. Dexterity is an expression of co-ordination — the greater a gladiator's dexterity, the more likely it is that he will be able to dodge a blow.

Tactics Made Simple

In essence, 'Gladiators' is a computer-moderated guessing game in which the player aims to beat the machine by making a succession of tactical decisions. The human habit of assuming that anything that can make decisions must be intelligent, adds to the interest of the game, since the semi-random manoeuvres of the computer's gladiator can often seem to be more planned than they really are. On the basis of information about the capabilities of his opponent and himself, and the physical distance between the fighters, he decides upon one of six manoeuvres:

BASH — a blow to the enemy's head. The smaller the distance between the combatants, and the greater the attacker's strength, the more damage this will do to an opponent. If a blow is not dodged it will result in blows equal to the attacker's strength at a range of one, half that at range two, a third at range three, and so on. The number of blows is always rounded up to the nearest whole number, and brings about an equal decrease in the enemy's constitution. If constitution falls below one a fighter is dead.

DUCK — an attempted dodge of a blow to the head. When the dodge is attempted a random decimal number between 0 and 20 is worked out. If the result is less than the defender's dexterity rating the duck is successful, and the opponent's Bash has no effect. Of course if you weren't bashed in the first place you'd be wasting your time! One popular mistake is a Duck in response to a Stab in the guts. Not a recommended strategy!

CLOSE — a move towards the opponent. This brings about a decrease in the 'range' between the two fighters unless the other gladiator Closes or Retreats (see below). Range can never be less than one, and decreases by one unit at each Close by either combatant.

RETREAT — a move away from the enemy (cf Bloodnok, Major, Coward and Bar). Range increases by one for each retreat, hence if the player Retreats and the computer Closes in a turn, range will be unaffected. Maximum value is four, hence it is impossible to get completely out of range of your opponent. This rule may seem unfair, but it reflects the problem of players opting to avoid battle — in the Circus Maximus the Emperor might be expected to take a dim view of such a stratagem.

STAB — similar to a Bash, but a blow to the body of the opponent. It cannot be

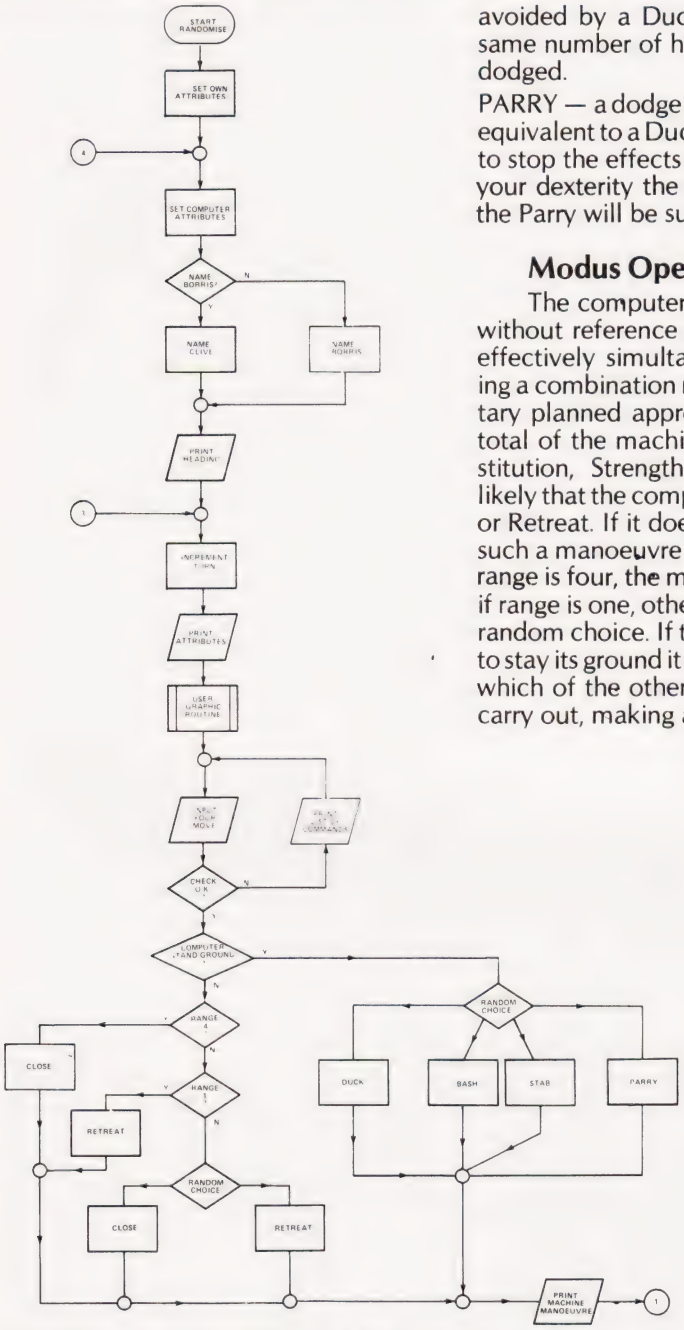

Fig.1. The main operating flowchart for the game.

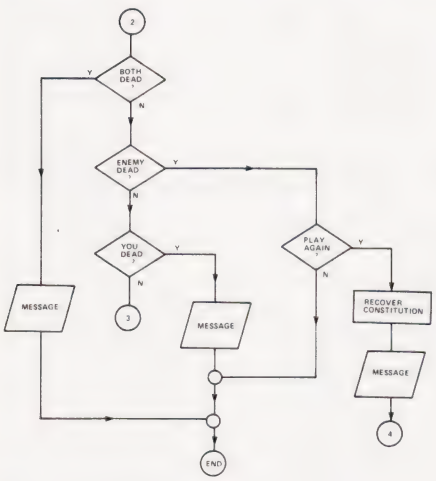

Fig.3. The endgame routines.

avoided by a Duck, and results in the same number of hits as a Bash if it isn't dodged.

PARRY — a dodge of a blow to the body, equivalent to a Duck for a Bash and used to stop the effects of a Stab. The higher your dexterity the more likely it is that the Parry will be successful.

Modus Operandi

The computer works out its moves without reference to yours (so they are effectively simultaneous decisions), using a combination random and rudimentary planned approach. The higher the total of the machine's 'attributes' (Constitution, Strength, Dexterity) the less likely that the computer will opt to Close or Retreat. If it does decide to carry out such a manoeuvre it will always Close if range is four, the maximum, and Retreat if range is one, otherwise making a 50:50 random choice. If the computer decides to stay its ground it will choose randomly which of the other four manoeuvres to carry out, making a decision influenced by its dexterity rating. This system is easily modified (lines 260-340 in the listing) to allow the computer to formulate a more 'intelligent' strategy — at the moment it is given an advantage of higher attributes than the player to make up for its moronic style of combat, but with practice and a little luck it is possible to defeat it half a dozen times in a row before you bite the dust. There is ample scope for tinkering in the Machine Move routine, but if it is improved the semi-random starting values of the attributes should be adjusted. Alter the 'recovery' value if you find that your character invariably loses his second battle — this value represents the effect of extra training and the healing of wounds. It might be interesting to give the player the choice of different types of training — the fixed number of recovery points could be optionally used to increase dexterity or strength instead of constitution. Upper limits of 10 for strength and 19 for dexterity would probably be a good idea if this system was used, otherwise a lucky gladiator could end up more like a Roman God, capable of dodging every

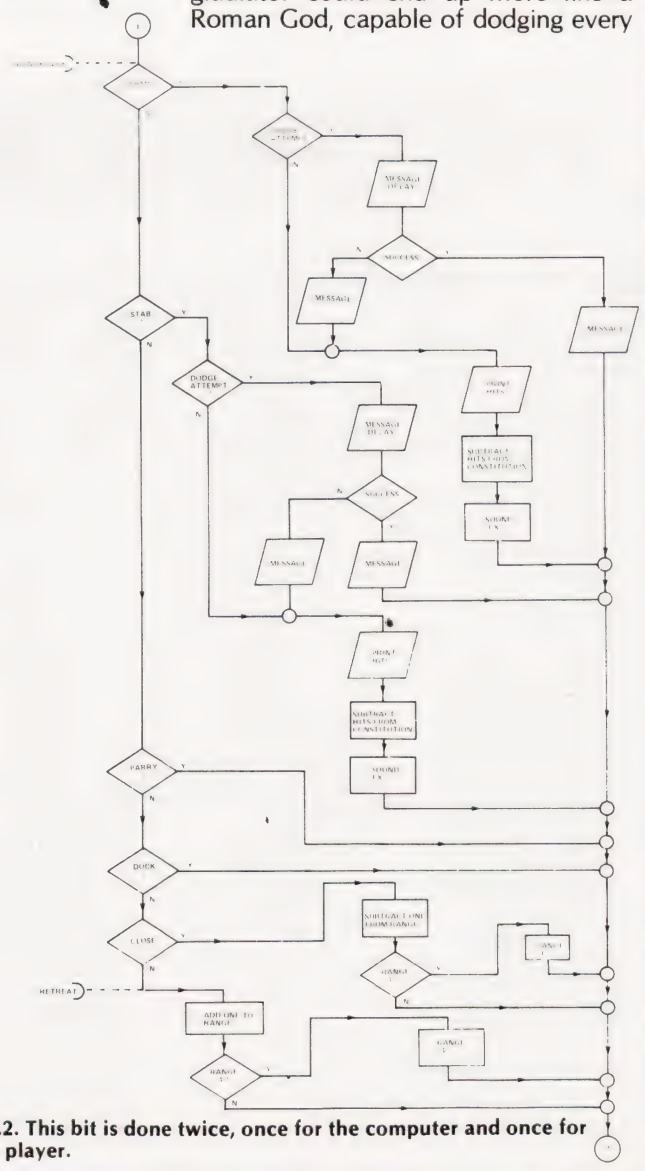

Fig.2. This bit is done twice, once for the computer and once for the player.

attack and killing off the opposition at a blow from long range.

The player tells the machine what move it has selected through his reply to the MANOEUVRE? command. If the first letter of the response is B(ash), S(tab), P(arry), D(uck), R(etreat) or C(lose) the appropriate tactic is carried out. If any other character is used at the start of the response a scolding message appears followed by a list of the valid instructions, followed by the MANOEUVRE? question once again. An entry of ? has the same effect, but without the message.

Modo Et Forma

The BASIC used in the program is slightly non-standard but should be easy to convert for most microcomputer implementations of the language. All the variables except M are integer types, marked by the % symbol in the listing. If a decimal is assigned to one of these it is rounded down to the nearest whole number. Omit the % symbols if your BASIC does not allow integer variable types, but bear in mind that you will need to put in some INT( ) statements to use the program with floating point numbers. The function Y = RND returns a random decimal between zero and one, and the random number sequence is 'seeded' to be different at each playing by use of the RANDOMIZE statement at the start of the program. The SLEEP 2 instruction (for example) generates a time delay of two seconds in the running of the program, and can be replaced by a FOR...NEXT loop or omitted altogether by the impatient.

To make the program as portable as possible few graphics or print formatting routines have been included in the version of the game listed. The text graphics used should work without modification on any 80 character wide display with a TAB command referenced to the left-hand screen edge. Semicolons in PRINT statements indicate that elements separated by the symbol should be printed without intervening spaces — commas space items out to the start of successive 'TAB fields', each of which is eight character-positions wide. The STRING$ (X,Y) command returns a string of X characters of ASCII code Y — for example STRING$ (5,42) returns "*****".

What Goes Where

Variables used in the program listing are as follows:

S% Player Strength
C% Player Constitution
D% Player Dexterity
U% Your move No
R% Range between fighters
T% Computer Strength
N% Computer Constitution
A% Computer Dexterity
M Computer move No
P% Turn No
G%, L%, V% General-purpose
B$ Commands
N$ Enemy name
A$ Reply variable

The program flowchart has been split into three sections to ease understanding. The middle section is executed twice, once for the computer's move and once for the player's. The section of program uses a computed GOSUB to conform with the tactical instructions, but this has to be shown on the flowchart as a series of Yes/No branches. The listing alternates two names for the gladiators — Borris and Clive (dedicated to a certain engineer...). For extra variety a more extensive table of names could be incorporated.

Aggressive Adventures

The 'Gladiators' program could be easily built into a home-made BASIC adventure game, to add variety. Build up an array of names and attributes of the characters in your game, and call 'Gladiators' up as a subroutine when required. Use a string array to contain the commands if you want to avoid upsetting DATA pointers in a big program. Alternatively a room could be set up using the 'Circus Maximus' theme, with add-ons such as the Imperial thumbs-down and so forth.

May the best man win...

Program Listing

```
 89  REM**INITIALISE
 90  RANDOMISE
100  S%=5:C%=9+RND*3:D%=8+RND*6
105  N$="BORRIS"
110  T%=5+RND*6:N%=9+RND*5:A%=9+RND*4:U%=5:M=5
115  PRINT:PRINT:R%=4:IF LEN(N$)=6 THEN N$="CLIVE"
     ELSE N$="BORRIS"
120  PRINT STRING$(33,35);
130  PRINT " GLADIATORS ";
140  PRINT STRING$(33,35)
149  REM**LOOP START
150  PRINT:PRINT:P%=P%+1:PRINT"[2 SPC]TURN NUMBER
     ";P%
160  PRINT TAB(23);"STRENGTH[3 SPC]CONSTITUTION
     [3 SPC]DEXTERITY":PRINT
170  PRINT"YOU : ",,S%,C%,D%:PRINT
180  PRINT N$;" :",,T%,N%,A%:PRINT
190  RESTORE:GOSUB 3000:V%=0:U%=0
200  INPUT"MANOEUVRE ";A$
210  IF LEFT$(A$,1)<>"?" THEN 220
215  FOR G%=1 TO 6:READ B$:PRINT B$,:NEXT G%:
     PRINT:GOTO 200
220  RESTORE:FOR G%=1 TO 6:READ B$
230  IF LEFT$(B$,1)=LEFT$(A$,1) THEN U%=G%
240  NEXT G%:RESTORE
250  IF U%=0 THEN PRINT"VALID COMMANDS ARE",:GOTO
     215
259  REM**MACHINE MOVE
260  M=RND*(55+F%/..):F%=T%+N%+A%+15
270  IF M>F% THEN 320
280  M=RND:IF M*30>11+A% THEN M=1:GOTO 350
290  IF M>.5 THEN M=2:GOTO 350
300  IF M*36>A% THEN M=3:GOTO 350
310  M=4:GOTO 350
320  IF R%=1 THEN M=5:GOTO 350
330  IF R%=4 THEN M=6:GOTO 350
340  M=INT(RND*2)+5
350  PRINT:PRINT N$;" RESPONDS WITH A ";
360  FOR G%=1 TO 6:READ B$:IF G%=M THEN PRINT B$:
     PRINT
370  NEXT G%
379  REM**THE BATTLE
380  ON M GOSUB 800,850,900,950,1000,1050
390  ON U% GOSUB 500,550,600,650,700,750
399  REM**COMBAT RESULTS
400  IF C%>0 OR N%>0 THEN 410
402  PRINT"OH DEAR, YOU'RE BOTH MORTALLY
     WOUNDED."
405  PRINT"BETTER LUCK NEXT TIME.":GOTO 10000
410  IF N%>0 THEN 420
412  PRINT N$;" FALLS TO THE GROUND AND EXPIRES.";
415  PRINT" WELL DONE, WANT ANOTHER GO ?":GOTO 440
420  IF C%>0 THEN 150:REM**NEXT TURN
425  PRINT"SORRY, BUT IN A FIT OF ENTHUSIASM ";
430  PRINT"YOU SEEM TO HAVE SNUFFED IT."
435  PRINT"YOU SURVIVED FOR ";P%;" TURNS.":GOTO
     10000
440  INPUT A$:IF LEFT$(A$,1)<>"Y" THEN 10000
450  G%=RND*7+2:PRINT"YOUR CONSTITUTION RECOVERS
     BY ";G%
460  C%=C%+G%:L%=0
470  GOTO 110
499  REM**YOU BASH
500  IF M<>4 THEN 530
505  PRINT N$;" ATTEMPTS TO DODGE - ";
510  SLEEP 5
520  IF RND*20<A% THEN PRINT"AND SUCCEEDS.":GOTO
     545
525  PRINT"AND FAILS."
530  PRINT:PRINT"HITS ON HIM ARE ";
535  G%=(S%/R%)+.999:PRINT G%,:N%=N%-G%
540  GOSUB 2000
545  RETURN
```

```
549  REM**YOU STAB
550  IF M<>3 THEN 575
555  PRINT N$;" TRIES TO DODGE - ";
560  SLEEP 2
565  IF RND*20<A% THEN PRINT"AND SUCCEEDS.":GOTO
     590
570  PRINT"AND FAILS."
575  PRINT:PRINT"HITS ON HIM ARE ";
580  G%=(S%/R%)+.999:PRINT G%,:N%=N%-G%
585  GOSUB 2000
590  RETURN
599  REM**YOU PARRY
600  RETURN
649  REM**YOU DUCK
650  RETURN
699  REM**YOU RETREAT
700  R%=R%+1:IF R%>4 THEN R%=4
710  RETURN
749  REM**YOU CLOSE
750  R%=R%-1:IF R%<1 THEN R%=1
760  RETURN
799  REM**ENEMY BASH
800  IF U%<>4 THEN 830
805  PRINT"YOUR ATTEMPTED DODGE - ";
810  SLEEP 3
820  IF RND*20<D% THEN PRINT"SUCCESS!":GOTO 840
825  PRINT"NO LUCK."
830  PRINT:PRINT"HITS ON YOU ARE ";
835  G%=(T%/R%)+.999:PRINT G%,:C%=C%-G%
840  GOSUB 2000
845  RETURN
849  REM**ENEMY STAB
850  IF U%<>3 THEN 875
855  PRINT"YOUR ATTEMPTED DODGE - ";
860  SLEEP 4
865  IF RND*20<D% THEN PRINT"SUCCESSFUL.":GOTO 890
870  PRINT"WITHOUT SUCCESS."
875  PRINT:PRINT"HITS ON YOU ARE ";
880  G%=(T%/R%)+.999:PRINT G%,:C%=C%-G%
885  GOSUB 2000
890  RETURN
899  REM**ENEMY PARRY
900  RETURN
949  REM**ENEMY DUCK
950  RETURN
999  REM**ENEMY RETREAT
1000 R%=R%+1:IF R%>4 THEN R%=4
1010 RETURN
1049 REM**ENEMY CLOSE
1050 R%=R%-1:IF R%<1 THEN R%=1
1060 RETURN
1999 REM**SOUND FX?
2000 ON G% GOSUB 2020,2030,2040,2050,2060,
     2070,2080,2090
2010 PRINT:RETURN
2020 PRINT"COUGH...":RETURN
2030 PRINT"GASP....":RETURN
2040 PRINT"YAEGH...":RETURN
2050 PRINT"EUFFF...":RETURN
2060 PRINT"REUCH...":RETURN
2070 PRINT"TAERCK..":RETURN
2080 PRINT"ARGHHH..":RETURN
2090 PRINT"@@#!@<<!":RETURN
2999 REM**VISUAL DISPLAY
3000 PRINT:PRINT"RANGE ";R%;".";TAB(29-R%);
3010 IF U%=4 THEN PRINT"* ";ELSE PRINT" *";
3020 IF M=4 THEN PRINT TAB(30+R%);" *";ELSE PRINT
     TAB(30+R%);"* ";
3030 PRINT TAB(64);"<- SEPARATION."
3040 PRINT TAB(30-R%);"]";:IF U%=3 THEN PRINT")";
3050 IF U%=2 THEN PRINT"\";
3055 IF U%=1 THEN PRINT"~";
3060 IF M=1 THEN PRINT TAB(29+R%);"~";
3065 IF M=2 THEN PRINT TAB(29+R%);"/";
3070 IF M=3 THEN PRINT TAB(29+R%);"(";
3075 IF M>3 THEN PRINT TAB(29+R%);" ";
3080 PRINT TAB(30+R%);"[":PRINT TAB(30-R%);"[";
     TAB(30+R%);"]":PRINT
3090 RETURN
8999 REM**LIST OF COMMANDS
9000 DATA BASH,STAB,PARRY,DUCK,RETREAT,CLOSE
9999 REM**THAT'S ALL FOLKS
10000 END
```

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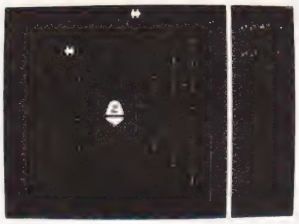

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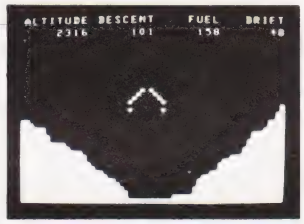
Lunar Lander Land a spacecraft on a lunar crater; altitude velocity, fuel and drift. Program 1K, graphics ½K.
Black Box Deduce the position of four invisible objects in the Black Box by firing rays at them. Program 4K, graphics ½K.



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Reversi Reversi, or Othello played with counters that are black one side and white on the other; Program 3K, graphics ½K. COLOUR

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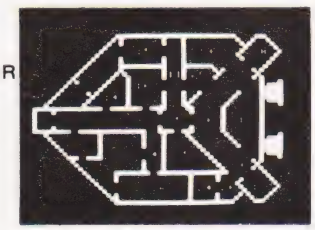
Green Things An alien life-form has invaded your space-craft; discover a way of destroying it with the weapons available on the ship Program 5K, graphics 2K. COLOUR
Ballistics Take turns in firing shells at the other player, taking into account the wind and shape of the hill, Program 3K, graphics 6K, needs floating-point.
Snake Grow yourself a snake by guiding it towards digits which it eats. Program 2K, graphics ½K.



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UPGRADE YOUR PET

Mike James

Expanding the memory capacity of your 16K PET can be a relatively simple operation if you follow our guide

When the first PETs were introduced in 1978 their standard 4K seemed to be both adequate and a bargain! Now it seems strange that anyone could have managed to write a program in so small a space and *why* would anyone build a machine with such little storage?! In microelectronics things move fast and most microcomputer owners soon find that the machine they bought as 'just what they needed' is now too small. For both the 4K and 8K PETs the only solution is to buy a memory expansion unit, either an internal board or an external box. For the more recent 16K PETs expansion to 32K can generally be achieved simply by changing a number of memory chips on the main logic board. This modification is simple and should be within the capabilities of anyone willing to take the covers off.

It appears that in some models Commodore deliberately prevented the modification I suggest by drilling holes in the part of printed circuit board where the extra chips would otherwise be mounted. People who find quarter inch holes in their PET's PCB should *not* try to upgrade as described in this article.

Having said that, it should be pointed out that any modifications carried out will render any remaining guarantee on your PET invalid and if you do get stuck you may have to pay to be rescued. So, before you begin, read this article carefully, open and examine your PET and make sure that you feel up to the work BEFORE you place your order for the necessary chips and things.

Two PETs!

When Commodore introduced the 16K PET they did, in fact, introduce two different versions: a true 16K machine and a 32K machine with half of the memory left out (which I shall refer to as a 16/32K machine). Conversion of the 16/32K type is considerably easier than for the 16K type. Before conversion we have to discover which it is we have. In all of the PETs that I've encountered the 16K versions were called '2000 series' and the 16/32K types were called '3000 series' so by looking at the front legend you should have a good idea of which type you've got. However, I cannot claim that this observation always holds true so the only sure way of discovering your type is to look at the main logic board. This is not too difficult. First the case of the PET has to be opened. The best way to do this is to tip the PET over so that it is resting on its back and remove the four Philips screws, near the front holding the black base to the cover. Then tip the entire PET back to its usual position and hinge the cover up (display screen and all!) to reveal the main logic board. To make things easier a metal arm will be found on the left hand side inside the cover which can be used to prop the cover up in much the same way as the bonnet of a car (Commodore think of everything!).

After marvelling at how pretty the inside of your PET is (it runs all your programs *and* it looks pretty!) it's necessary to identify a few components. Looking at the front right hand side of the main logic board (Fig.1 should help) you will see either two rows, each of eight chips, one labelled (on the board) UI2 to UI9 and the other labelled UJ2 to UJ9 or one row of chips labelled (on the board) UI2 to UI9 and one row of eight ghostly solder-filled chip locations where chips might have been expected. If you have two rows of chips then you have a 16K PET: a further check is that each of the chips should bear the number 4415 somewhere. If you can only find one row of chips you have a 16/32K PET and a further check for this is that each of the chips should bear the number 4416 somewhere. While you have the cover open it's worth identifying the other two relevant items on the main logic board, the 'programming links'. If you look towards the back of the board on the right hand side near the edge you should be able to locate two black plastic strips with metal bands at right angles (some of the metal bands will have been cut through). When you have found them, all that is necessary for the time being is to notice that they are labelled as shown in Fig.2.

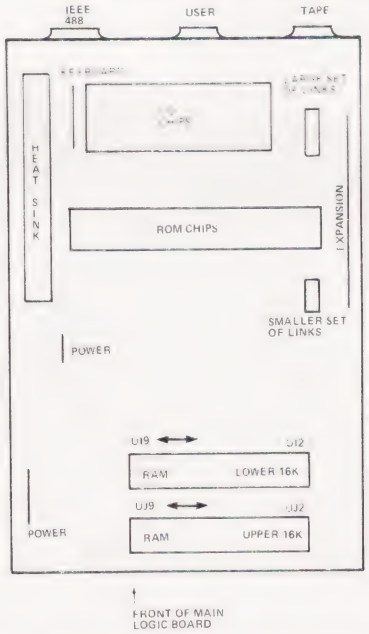


Fig. 1. The layout of the circuit board showing the locations of the main components.

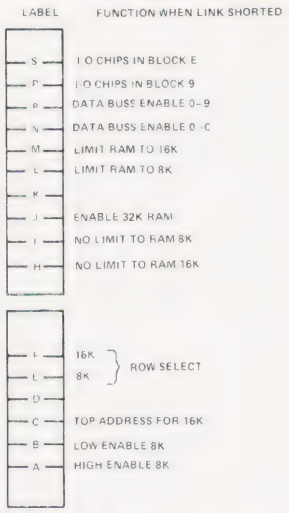
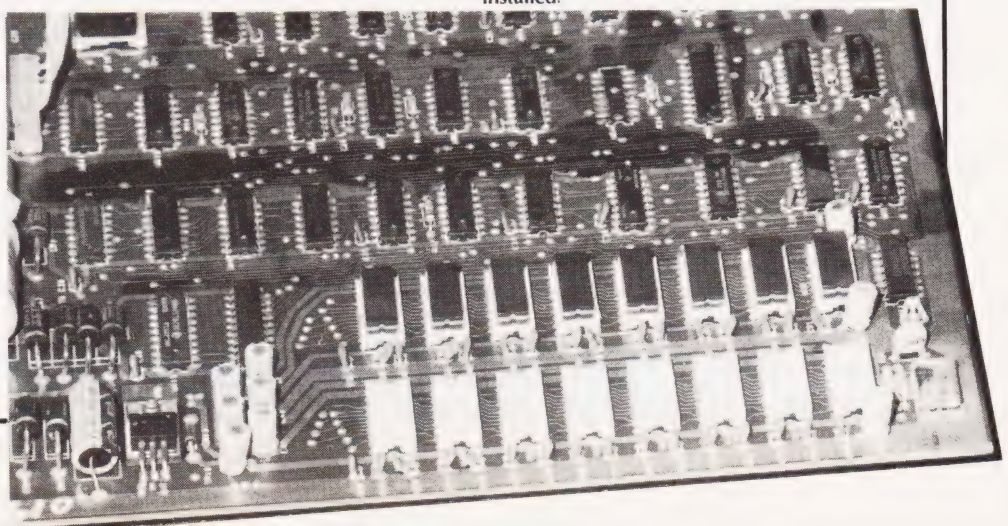


Fig. 2. What the links do.

Desoldering

Most 'how to do it' articles use their words to tell the novice how to solder a

Halfway through upgrading with the new sockets installed.



chip into place without heating it to the point of no return — ie how to notice that it's about to flow off the side of the board in a black plastic puddle. In this case it's *desoldering* that is our problem. Desoldering differs from soldering in that, in general, the component that we are removing is of little importance, so the condition that it leaves the board in doesn't matter. This would make desoldering easy if it wasn't for the fact that we are concerned about the state of the printed circuit board *after* the component is removed. Too much heat will remove the copper tracks from a board more easily than the component.

I've tried most of the methods of desoldering on the market and talked to people who've tried methods not in the text books (including one who favoured a blow lamp!) and one thing I've discovered is that there is no 100% sure method of removing components from a board without damage or frustration. But of the methods I've used I can recommend only one. The technique I favour is based on a *large* wattage soldering iron and a plunger type solder sucker. A large wattage iron is necessary to heat the solder on both sides of the board and the spring loader solder sucker is usually (as long as it has a newish tip) strong enough to remove most of the solder. The procedure is to heat the solder on the reverse side of the board, *without pressing hard* on the copper foil, and when the solder is well melted to place the tip of the solder sucker right over the hole and press the release button. If you've been successful all of the solder should be removed in one go. When all of the legs of a chip have been desoldered it can usually be removed with a small amount of pressure from a screwdriver (be careful not to damage the front copper tracks with the blade) or an IC remover. Notice that only a small amount of pressure should be used, because although it is possible to remove a partially desoldered chip from a board with brute force with no apparent harm it usually results in the through plating being ripped from the board. For those who don't know about through plating it means that the holes through the printed circuit board are plated with copper and serve to connect any copper tracks on the top of the board to any tracks on the bottom. If the removal of a chip has resulted in the destruction of any through plating it can usually be seen by the bits of reddish copper sticking to the legs of the removed chip.

Just as with soldering, desoldering needs practice and a certain amount of skill — but if you are patient it's not too difficult, especially if you buy the correct tools.

Converting The 16/32K PET

At last we come to the details of conversion and we start with the easier of the two, the 16/32K PET, which is also the cheapest. The components required are:

8 4116 Dynamic RAM(DRAM) chips (cost about £2.50 each)
8 16 pin DIL sockets (cost about 10 pence each).

The first job is to remove the main logic board. After *disconnecting your PET from the mains* unplug the connectors and remove the two screws from the logic board, being careful of the earth lead on the screw near the back. Then unclip the printed circuit board clips by pressing them in and lifting the board slightly.

The second job is to remove the solder from the vacant chip positions on the printed circuit board. This is relatively easy as long as you are patient — get the solder good and hot so that it is fluid on both sides of the hole and then place the nozzle of the desoldering tool right over the hole and press the button! If you're lucky the hole will be clear, if not try again. A tip worth knowing is that if you partially clear a hole it's sometimes easier to put some fresh solder on and start again rather than continue struggling. The only caution is — DO NOT press hard on the printed circuit board with the soldering iron — it doesn't get the board any hotter and it will remove the copper foil — so be gentle! After clearing all eight positions find an old toothbrush and scrub both sides of the board to remove loose solder and inspect *very carefully* for damaged tracks. If any damage is found then repair using very fine wire (wire wrap gauge is ideal). The 8 chip sockets should now be soldered onto the top side of the board. Then the memory chips themselves should be pushed into place with the same orientation as the existing chips. This can be difficult. It helps to bend the legs of the chips to the right positions and then push them home in one movement. It is important that the new chips are the *same way round* as the old ones.

At this stage check that the configuration of the wire 'programming links' is as shown in Fig.3. If not alter them accordingly. Replace the main logic board by reversing the procedure for removal. It is important not to forget to replace the earth cable under the screw at the back of the board. Close the PET and reconnect the mains. When you switch on you should be greeted by

31743 BYTES FREE

If not, read the section on fault finding and even if you have the correct answer run the memory diagnostic given in that section to make sure everything's OK.

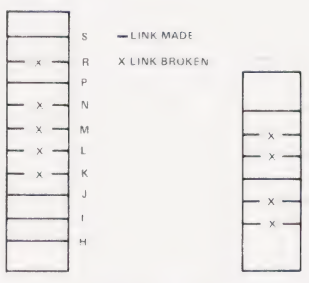


Fig. 3. How the links should look after upgrading.

Converting The 16K PET

This is a little more difficult and expensive. The components you require are:

16 4416 DRAM chips
16 16 pin DIL sockets.

First the main logic board has to be removed as described for the 16/32K machine. The next job is the most difficult: each of the 16 memory chips marked UI2 to UI9 and UJ2 to UJ9 on the board have to be removed. This can be done by using the desoldering method earlier described, or by cutting the pins of the chips with a good quality pair of side cutters and then removing the end pins with a hot soldering iron and clearing the holes as for the 16/32K conversion. If this 'cut and rip' method is used then obviously the chips that are removed are useless but it is the safest way. Again it is important to work with care to avoid damaging the printed circuit board.

After this operation is complete the chip sockets should be soldered in and the chips added. Again, they should be the *same way round* as the old chips. Before closing the case and testing we have to alter the two sets of 'programming links' mentioned earlier. These should be as shown in Fig.3 and the links must be cut and joined with solder accordingly.

Finally switch on and test.

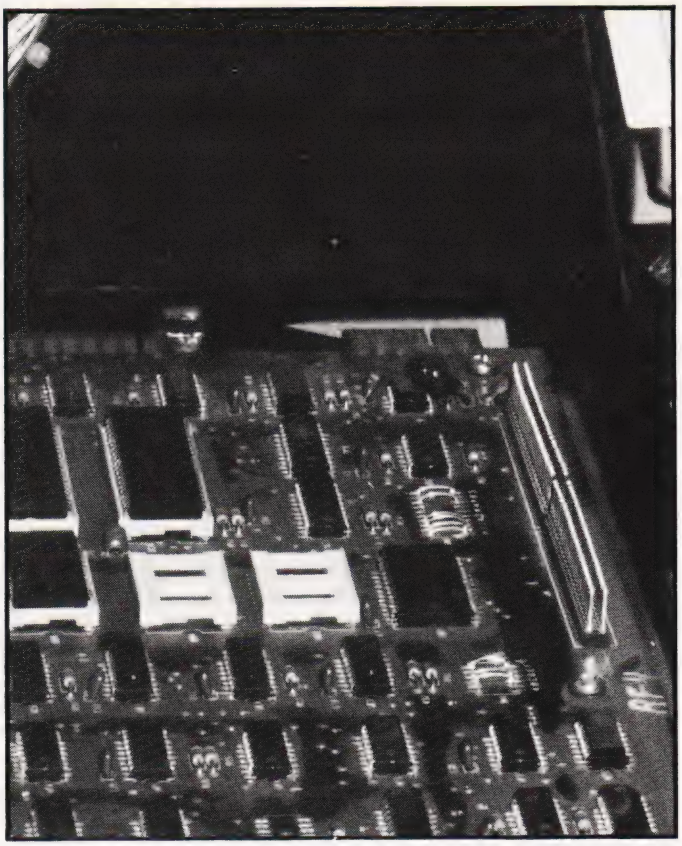
Testing And Repairing

If you are not greeted with PET's 32K sign-on then you have problems and even if you are you may still have problems! To check your memory run the diagnostic program given below and note the results. If you can't even get the program in then your first 2K of memory has got troubles. Any faults found by the diagnostic program can be pinned down to the printed circuit board or a chip by the simple method of moving the lower row of eight chips to the top row and vice versa. If the fault moves then a chip is the cause. Which one can be found by swapping chips within a row. If the fault stays put then the printed circuit board or socket is the problem. Remake all the

joints and check for solder bridges etc. If all fails then you need a logic probe to find out which lines are shorted or not connected and if you haven't got one — you need help.

If after reading this article you are in the least bit doubtful about conversion — then don't. However, it is relatively easy, and apart from trouble with the printed circuit board very little can go wrong. If you have a 16/32K PET then it is especially trouble free because unsoldering filled IC pads is almost impossible to do incorrectly and the worst that can happen is that a fault will lie in one of the new memory chips.

Happy desoldering!

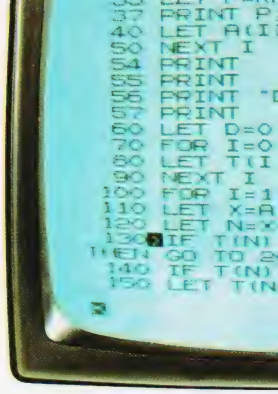


The links show up clearly here at the rear of the board.

```
10  INPUT "START ADDRESS"; A:REM** (typical value of A —
    2000)
20  INPUT "END ADDRESS"; B:REM** (typical value of B —
    31000)
30  FOR I = A TO B
40  POKE I, 170
50  NEXT I
60  FOR I = A TO B
70  IF PEEK(I) < >170 THEN PRINT "ERROR AT";I
80  POKE I,85
90  NEXT I
100 FOR I = A TO B
110 IF PEEK(I) < >85 THEN PRINT "ERROR AT";I
120 NEXT I
```

The memory test program.

New! Sinclair ZX81 Personal Computer.



Kit: £49.95 complete

Built: £69.95 complete

Reach advanced computer comprehension in a few absorbing hours

1980 saw a genuine breakthrough – the Sinclair ZX80, world's first complete personal computer for under £100. At £99.95, the ZX80 offered a specification unchallenged at the price.

Over 50,000 were sold, and the ZX80 won virtually universal praise from computer professionals.

Now the Sinclair lead is increased: for just £69.95, the new Sinclair ZX81 offers even more advanced computer facilities at an even lower price. And the ZX81 kit means an even bigger saving. At £49.95 it costs almost 40% less than the ZX80 kit!

Lower price: higher capability
With the ZX81, it's just as simple to teach yourself computing, but the ZX81 packs even greater working capability than the ZX80.

It uses the same micro-processor, but incorporates a new, more powerful 8K BASIC ROM – the 'trained intelligence' of the computer. This chip works in decimals, handles logs and trig, allows you to plot graphs, and builds up animated displays.

And the ZX81 incorporates other operation refinements – the facility to load and save named programs on cassette, for example, or to select a program off a cassette through the keyboard.

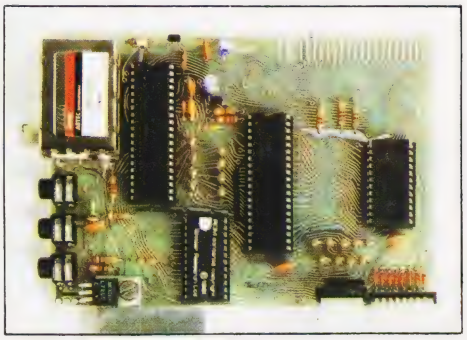
Higher specification, lower price – how's it done?
Quite simply, by design. The ZX80 reduced the chips in a working computer from 40 or so, to 21. The ZX81 reduces the 21 to 4!

The secret lies in a totally new master chip. Designed by Sinclair and custom-built in Britain, this unique chip replaces 18 chips from the ZX80!

Kit or built – it's up to you!

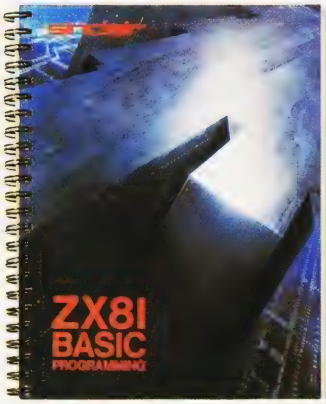
The picture shows dramatically how easy the ZX81 kit is to build: just four chips to assemble (plus, of course the other discrete components) – a few hours' work with a fine-tipped soldering iron. And you may already have a suitable mains adaptor – 600 mA at 9 V DC nominal unregulated (supplied with built version).

Kit and built versions come complete with all leads to connect to your TV (colour or black and white) and cassette recorder.

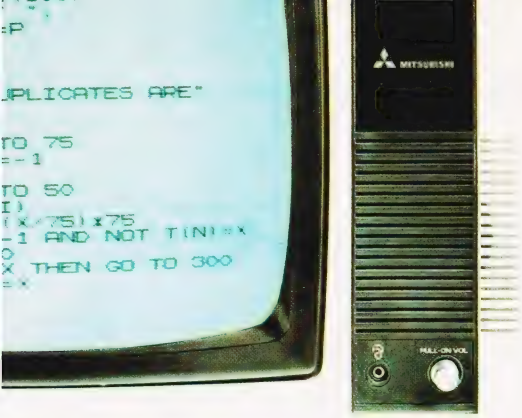


Proven micro-processor, new 8K BASIC ROM, RAM – and unique new master chip.

New BASIC manual



Every ZX81 comes with a comprehensive, specially-written manual – a complete course in BASIC programming, from first principles to complex programs.



If you own a Sinclair ZX80...

The new 8K BASIC ROM used in the Sinclair ZX81 is available to ZX80 owners as a drop-in replacement chip. (Complete with new keyboard template and operating manual.)

With the exception of animated graphics, all the advanced features of the ZX81 are now available on your ZX80 – including the ability to drive the Sinclair ZX Printer.

Coming soon- the ZX Printer.

Designed exclusively for use with the ZX81 (and ZX80 with 8K BASIC ROM), the printer offers full alpha-numerics across 32 columns, *and* highly sophisticated graphics. Special features include COPY, which prints out exactly what is on the whole TV screen without the need for further instructions. The ZX Printer will be available in Summer 1981, at around £50 – watch this space!

16K-BYTE RAM pack for massive add-on memory.

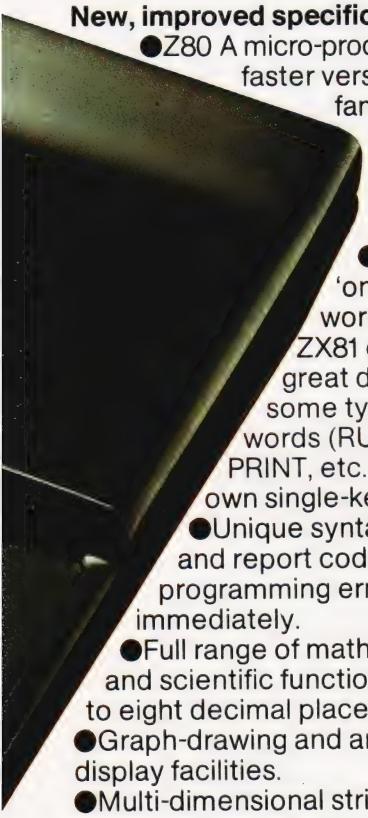
Designed as a complete module to fit your Sinclair ZX80 or ZX81, the RAM pack simply plugs into the existing expansion port at the rear of the computer to multiply your data/program storage by 16!

Use it for long and complex programs or as a personal database. Yet it costs as little as half the price of competitive additional memory.

How to order your ZX81

BY PHONE – Access or Barclaycard holders can call 01-200 0200 for personal attention 24 hours a day, every day. BY FREEPOST – use the no-stamp-needed coupon below. You can pay by cheque, postal order, Access or Barclaycard. EITHER WAY – please allow up to 28 days for delivery. And there's a 14-day money-back option, of course. We want you to be satisfied beyond doubt – and we have no doubt that you will be.

New, improved specification



- ●Z80 A micro-processor – new faster version of the famous Z80 chip, widely recognised as the best ever made.
- ●Unique 'one-touch' key word entry: the ZX81 eliminates a great deal of tire-some typing. Key words (RUN, LIST, PRINT, etc.) have their own single-key entry.
- ●Unique syntax-check and report codes identify programming errors immediately.
- ●Full range of mathematical and scientific functions accurate to eight decimal places.
- ●Graph-drawing and animated-display facilities.
- ●Multi-dimensional string and numerical arrays.
- ●Up to 26 FOR/NEXT loops.
- ●Randomise function – useful for games as well as serious applications.
- ●Cassette LOAD and SAVE with named programs.
- ●1K-byte RAM expandable to 16K bytes with Sinclair RAM pack.
- ●Able to drive the new Sinclair printer (not available yet – but coming soon!)
- ●Advanced 4-chip design: micro-processor, ROM, RAM, plus master chip – unique, custom-built chip replacing 18 ZX80 chips.

sinclair ZX81

Sinclair Research Ltd,
6 Kings Parade, Cambridge, Cambs.,
CB2 1SN. Tel: 0276 66104.
Reg. no: 214 4630 00.

To: Sinclair Research Ltd, FREEPOST 7, Cambridge, CB2 1YY. **Order**

Qty	Item	Code	Item price £	Total £
	Sinclair ZX81 Personal Computer kit(s). Price includes ZX81 BASIC manual, excludes mains adaptor.	12	49.95	
	Ready-assembled Sinclair ZX81 Personal Computer(s). Price includes ZX81 BASIC manual and mains adaptor.	11	69.95	
	Mains Adaptor(s) (600 mA at 9 V DC nominal unregulated).	10	8.95	
	16K-BYTE RAM pack(s).	18	49.95	
	8K BASIC ROM to fit ZX80.	17	19.95	
	Post and Packing.			2.95

Please tick if you require a VAT receipt ☐ **TOTAL £** _____

*I enclose a cheque/postal order payable to Sinclair Research Ltd, for £ _____

*Please charge to my Access/Barclaycard/Trustcard account no.

_____

*Please delete/complete as applicable. Please print.

Name: Mr/Mrs/Miss _____

Address _____

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FREEPOST – no stamp needed. COT09

DISC PURGE

Tony Lacy

An intelligent disc management utility for TRS 80s

This program is intended to run on a system with one or more disc drives. With the CLEAR argument and array sizes shown it occupies 5K bytes in memory and 3 granules on disc. It is written in DISC BASIC 1.1 and needs to run under NEWDOS. A 'system' disc should be in drive :0 at all times.

Purpose Of The Program

I recently purchased a second disc drive unit and decided to re-arrange my disc files to take maximum advantage of the upgrade. The plan involved using drive :0 to hold utility programs and, of course, the DOS.

Drive :1 would contain any other programs or data and the discs would be data discs containing a minimum of system information (BOOT/SYS and DIR/SYS).

On the face of it this would involve formatting discs and transferring the required files over from a system disc, using FORMAT and COPY, a laborious task. Well, there is another way. If all the system files (except BOOT/SYS, DIR/SYS and any other programs or data) could be removed we would end up with a data disc. This is one of the functions of the program.

There was also a need to remove duplicated files, backup copies, etc, and I had been playing around with TRS 80 FORTRAN — this seems to spawn hundreds of superfluous files! The other main function of the program is to remove the tedium of KILLXXXX, KILLYYYY, and so on. Instead of this the user is presented with the question 'KILL Y OR N' for each file, and the program does the rest. A search and kill of specified types of file can also be done, a typical example of this option would be to remove all of the '/BAS' files on a disc.

Using The Program

The program is self-prompting — just answer the questions as they appear. Since mistakes on disc files tend to be big ones, the input data is presented to the user for checking before any files are killed. Also, since drive :0 must always contain a system disc the option 'REMOVE SYSTEM FILES' is not presented if drive :0 is selected. I would recommend that the program is tested thoroughly on a backup disc before it is let loose on your program library!

The 'KILL FILES BY CATEGORY' option requires some care in use, the user is prompted to 'ENTER KEY'. A string of characters is entered and the program will search for files containing the keyword as a superstring: I will give a few examples.

< SPACE > < ENTER > Most filespecs contain trailing spaces, usually as a 'blank' password, so this program would probably select ALL of the visible files for killing. You would be shown a list of these files, and be able to change your mind, BEFORE the files were killed.

If you typed < BAS > < ENTER > the following files would be selected, if present:

BASEBALL/CMD
TUBAS/REL
POOL/BAS
BBBASSS/CMD

To kill files with the 'BAS' extension the correct form would be < /BAS > < ENTER >, note the space.

How The Program Works

The main problem was to get directory information into the program from disc since DIR/SYS is not readable like a normal file. I have seen some clever ways of doing this, for example a special DCB can be defined in machine code and DIR/SYS can be read into a buffer which also happens to be a string array. The array could then be processed by a BASIC program. Well, I didn't do it like that!

The method used here is to get a directory display onto the screen using CMD 'XXXXX', this method of accessing DOS is not available in TRSDOS, by the way. The screen information is then PEEKed into a string array.

Refer to the main program listing for the following description.

LINE 50 Defines string space and array sizes, the values given work fine on my system, you might have to change them. Note the use of '$' character in the program, all variables not defined as strings are integers.

LINES 70-130 Various functions are defined here for use later, see the associated :REM statements in the listing.

LINES 160-190 The command for killing system files is built up, a 'universal' password is added and the file currently being killed is displayed.

LINES 200-340 These are keyboard input routines, the routine at 230 is similar in function to the standard INPUT statement, except that pressing < ENTER > does not print a line feed to the screen, this is useful when we need to use the bottom line but wish to avoid a screen scroll.

LINES 360-440 The main program starts here and asks the user which drive is to be used, so that it can present the correct options in the next section.

LINES 460-560 Get the option and set various flags, depending on the choice. Refer to the list of variables used for information on these flags.

LINES 580-740 The directory for the target file is displayed and as file information is extracted, it is flagged in line 690 or 720, depending on the option previously selected, and if it is to be killed. We wish to avoid screen scrolling at this stage and so the subroutine at 230 is used to enter strings. If there are so many files that the directory display scrolls off the screen then the program will only kill the files which appear below print position 192, you can either run it twice or kill the extra files manually.

LINES 760-740 The files to be killed are displayed for a final check. If the list is correct then mass murder begins!

LINES 830-980 The files are killed, if a 'P' followed the filename then the program halts and requests the password. If the incorrect password is given then the error is trapped and you are given the choice to try again or go on to the next file.

LINES 1000-1090 This is the error trapping routine, its function is to take action on either ERROR70 (FILE ACCESS DENIED) or ERROR54 (FILE NOT FOUND). Any other error will be processed in the normal way, that is with program halt and the usual error message. The list of disc related error codes in the TRSDOS manual is *not* correct, by the way.

LINES 1100-1270 This section does a system purge, it converts a system disc into a data disc without affecting user files or data. This section can only be used if drive :0 was NOT selected, suitable stern warnings are given on the screen before the killing starts. If a particular system file is not present a message is displayed and the program continues.

And that's it! The program was concocted for a specific purpose and I hope that it will be as useful to others as it has been to me.

Variables Used

A	Dummy variable
BLANKS	Function name, returns 0 if no password
C	Set to 1 if option 2 is selected
ENT	Set to 1 if keyboard character was < ENTER >
FLAG	Used to mark files to be killed
G	Set to 1 if system purge was selected
I-I7	Loop counters, array pointers
KEY	Key string for option 3
L	Dummy variable
LEAD	Function name, removes a leading character
M	Dummy variable
MAX	Maximum acceptable keyboard input
MIN	Minimum acceptable keyboard input
ND	Target drive number
PASS	Password for protected files
Q$	Used in 'CMD 'XXX'' statement
SYS	Name of SYSTEM file to be killed
TRAIL	Function name, removes trailing blanks
U	Single character returned from keyboard
UD	As U but between MIN and MAX, or < ENTER >
VID	Filespec, obtained from video display
ZAP	Filespec, including password and drive number.

Program Listing

```
10 REM**DISC PURGE
20 REM**INITIALISE, ARRAYS MAY NEED TO BE LARGER FOR
30 REM**SOME SYSTEMS
40 REM**SUGGEST REMOVE REMS FOR WORKING VERSION
50 CLEAR 1000:CLS:DEF INT A-J:DEF STR K-Z:DIM VID(42),
   FLAG(42)
60 REM**REMOVES TRAILING BLANKS FROM A STRING
70 DEF FNTRAIL(M) = MID$(M,1,INSTR(M," ") - 1)
80 REM**REMOVES A LEADING CHR FROM A STRING
90 DEF FNLEAD(L) = RIGHT$(L,LEN(L) - 1)
100 REM**RETURNS ZERO IF PASSWORD IS BLANKS ONLY
110 DEF FNBLANKS(M) = INSTR(INSTR(M," "),M,"P")
120 ON ERROR GOTO 1000
130 GOTO 360
140 REM**SYSTEM FILE KILL
160 ZAP = SYS + ".NV36" + ":" + ND
170 PRINT@192,SYS;CHR$(30);
180 KILL ZAP
190 RETURN
200 REM**GET ONE CHARACTER FROM KEYBOARD
210 U = INKEY$:IF U = " " THEN 210 ELSE RETURN
220 REM**BUILD A STRING CALLED 'KEY'
230 GOSUB 210:IF U < " [SPC]" THEN RETURN
240 PRINT U;:KEY = KEY + U:GOTO 230
250 REM**GET A 'Y' OR 'N' FROM KEYBOARD
260 PRINT" --- Y OR N ";:GOSUB 210:IF U = "Y" OR U = "N"
   THEN RETURN
270 PRINT"PLEASE ANSWER 'Y' OR 'N' ";:FOR I6 = 1 TO 500:
   NEXT
280 PRINT STRING$(36,8);:GOTO 260
290 REM**GET A CHR BETWEEN MIN AND MAX OR SET FLAG
   ENT IF 'ENTER'
300 ENT = 0:GOSUB 210:IF U > = MIN AND U = < MAX THEN
   UD = U:RETURN
310 IF U = CHR$(13) THEN ENT = 1:RETURN
320 PRINT"BETWEEN ";MIN;" AND ";MAX;" PLEASE";:GOSUB
   330:GOTO 300
330 FOR I = 1 TO 500:NEXT:PRINT CHR$(29);:PRINT CHR$(30);:
   RETURN
340 RETURN
350 REM**START OF MAIN PROGRAM
360 PRINT TAB(20)"PURGE UTILITY 1.2"
370 PRINT TAB(20)"----------":PRINT:PRINT
380 PRINT"THIS UTILITY NEEDS TO HAVE A 'NEWDOS'
   SYSTEM DISC IN"
390 PRINT"DRIVE :0 AT ALL TIMES":PRINT
400 PRINT"WHICH DRIVE IS TO BE USED? (ENTER WILL
   DEFAULT TO :0)"
410 MIN = "0":MAX = "3":GOSUB 300
420 IF ENT = 1 THEN UD = "0"
430 PRINT"DRIVE :";UD;:GOSUB 260
440 IF U = "N" THEN RUN
450 KEY = " "
460 PRINT@192,CHR$(31);"DRIVE :";UD;"---SELECT YOUR
   OPTION";
470 PRINT" (OR ENTER TO START AGAIN)"
480 PRINT:PRINT:PRINT"0";TAB(10)"EXIT PROGRAM"
490 PRINT"1";TAB(10)"KILL SPECIFIED FILES"
500 PRINT"2";TAB(10)"KILL FILES BY CATEGORY"
510 IF UD < > "0" THEN PRINT "3" TAB(10);"REMOVE SYSTEM
   FILES"
520 MIN = "0":IF UD < > "0" THEN MAX = "3" ELSE MAX = "2"
530 ND = UD:GOSUB 300:IF ENT = 1 THEN RUN
540 IF UD = "0" THEN END
550 IF UD = "3" THEN 1110
560 IF UD = "2" THEN C = 1 ELSE C = 0
570 REM**GET FILESPECS FROM SCREEN INTO ARRAY 'VID'
580 Q$ = "DIR :" + ND
590 CMD"Q$"
600 IF C = 1 THEN PRINT@960,"ENTER KEY STRING ";:GOSUB
   230
610 FOR I = 15488 TO 16320 STEP 64:FOR I1 = 0 TO 40 STEP 20
620 FOR I2 = I + I1 TO I + I1 + 19:VID(I3) = VID(I3) + CHR$
   (PEEK(I2)
630 NEXT I2
640 IF C = 0 THEN PRINT@960,CHR$(30);
650 REM**IF 'FLAG' = 1 THEN FILE IS TO BE KILLED
660 FLAG(I3) = 0
670 IF LEFT$(VID(I3),1) = " [SPC]" THEN 760
680 IF C = 0 THEN 710
690 IF INSTR(VID(I3),KEY) < > 0 THEN FLAG(I3) = 1
700 GOTO 730
710 PRINT VID(I3);" --KILL";:GOSUB 260
720 IF U = "Y" THEN FLAG(I3) = 1
730 I3 = I3 + 1
740 NEXT I1,I
750 REM**DATA VERIFICATION
760 CLS:PRINT"THESE FILES ARE TO BE KILLED ON DRIVE
   :";ND;:PRINT
770 PRINT:FOR I4 = 0 TO I3
780 IF FLAG(I4) + 1 THEN PRINT VID(I4),
790 NEXT I4
800 PRINT:PRINT:PRINT"CORRECT? ";:GOSUB 260
810 REM**ESCAPE CLAUSE
820 IF U = "N" THEN RUN
830 CLS:PRINT"KILLING FILES, DRIVE :";ND;:PRINT
840 FOR I4 = 0 TO I3 - 1
850 IF FLAG(I4) = 0 THEN 970
860 PRINT@192,VID(I4);CHR$(30),
870 ZAP = FNTRAIL(VID(I4))
880 IF FNBLANKS(VID(I4)) = 0 THEN 950
890 PRINT@192,VID(I4);" :";ND;"IS PASSWORD PROTECTED
   !!":PRINT
900 PASS = " "
910 INPUT"PASSWORD PLEASE";PASS
920 PRINT@213,CHR$(31);
930 REM**BUILD UP FILESPEC AND THEN KILL
940 ZAP = ZAP + "." + PASS
950 ZAP = ZAP + ":" + ND
960 KILL ZAP
970 NEXT I4
980 RUN
990 REM**TRAP ERRORS AND TAKE APPROPRIATE ACTION
1000 IF ERR = 138 THEN 1050
```

```
1010 IF G=0 THEN ON ERROR GOTO 0
1020 IF ERR<>106 THEN 1040
1030 PRINT@192,SYS;" NOT FOUND, CONTINUING";CHR$(30):
     FOR I5=1 TO 400:NEXT:RESUME NEXT
1040 ON ERROR GOTO 0
1050 PRINT:PRINT"ACCESS DENIED, TRY AGAIN (Y) OR SKIP
     THIS FILE (N)?"
1060 PRINT:PRINT"TYPE ";:GOSUB 260
1070 PRINT@192,CHR$(31);
1080 IF U="Y" THEN RESUME 870
1090 RESUME 970
1100 REM**SYSTEM PURGE
1110 CLS:PRINT"DRIVE :";ND;TAB(20)"!! WARNING !!"
1120 PRINT:PRINT"SYSTEM PURGE WILL KILL ALL '/SYS' FILES
     EXCEPT"
1130 PRINT"FOR BOOT/SYS AND DIR/SYS. IT WILL ALSO KILL
     FORMAT/CMD"
1140 PRINT"COPY/CMD AND BASIC/CMD"
1150 PRINT:PRINT"GO AHEAD? ";:GOSUB 250
1160 REM**ESCAPE CLAUSE FOR THE NERVOUS
1170 IF U="N" THEN RUN
1180 G=1:CLS:PRINT"KILLING SYSTEM FILES, DRIVE :";ND;:
     PRINT
1190 FOR I7=0 TO 13
1200 SYS="SYS"+FNLEAD(STR$(I7))+"/"+"SYS"
1210 GOSUB 160
1220 NEXT I7
1230 SYS="COPY/CMD":GOSUB 160
1240 SYS="FORMAT/CMD":GOSUB 160
1250 SYS="BASIC/CMD":GOSUB 160
1260 CLS:PRINT:PRINT"SYSTEM PURGE COMPLETE, PRESS
     ENTER TO CONTINUE"
1270 INPUT A:RUN
```

PET LISTER

Paul Williams

Convert PET's awkward graphics to CT standard codes

When PET BASIC programs are listed on a printer, the cursor controls and shifted characters are printed as cryptic symbols that are often difficult to decipher. This machine code program lists BASIC programs on paper, spacing out the statements (if necessary) and showing cursor control and shifted characters as more easily identifiable characters, these generally correspond to the CT standards.

A Clear Screen (normally "♥") is printed as "[CLS]"
A Cursor Down (normally "Q") is printed as "[CD]"

Shifted characters are printed as their unshifted versions but in square brackets ([ ]).

Using It

To list a BASIC program in this way, load the lister, type NEW and then load the BASIC program. If SYS 30000 is now typed, the program will be listed in this special way on the printer, as fast as a normal listing. After one SYS 30000, the area of memory used for the lister program will be protected from being overwritten by strings, as the top of memory pointers are set by the machine code program.

The lister can be entered using an assembler, or using TIM. If you are using an assembler on an 8K machine, change BEGIN = $ 7530 to BEGIN = $ 1EDC and execute the program with a SYS 7900 instead. Because a number of zero-page and ROM addresses are used by the program, it will not work without considerable alteration on the Old ROM machines.

How It Works

As BASIC statements in a program are stored as single bytes (eg 128 for END and 153 for PRINT) to save memory and speed up the interpreter, reference has to be made to the ROM table of statements to print the correct characters for each command. If the lister finds a BASIC token byte while listing on the printer, it does not directly print it but finds the correct word in the ROM string starting at $ C092.

At $ 758D in the lister, if the LDA #0 is changed to LDA #32 (A9 00 Hex to A9 20 Hex), a space will automatically be printed after each keyword (eg PRINT, GOTO,/,— etc). This amendment can make program listings even clearer, but often it is better to leave $ 758D as LDA #0.

The actual method used by the lister is explained in the assembler listing, and the program takes just over 256 bytes.

The changes made to cursor control characters in the output of the lister are shown below:

	MEANING	NEW CHARACTERS
Q	DOWN CURSOR	[CD]
]	CURSOR RIGHT	[CR]
O	CURSOR UP	[CU]
▌	CURSOR LEFT	[CL]
S	HOME CURSOR	[HOME]
♥	CLEAR SCREEN	[CLS]
R	REVERSE FIELD	[RVS]
▬	OFF REVERSE FIELD	[OFF]

All shifted graphic symbols are printed as unshifted characters in square brackets.

```
1500 PRINTCHR$(147):CLR:DIMA$(50,10)
1510 PRINTTAB(12)"■REATE RECORD■":PRINT:
1520 GOSUB 2470:REM * LINE
1530 PRINT"WHAT IS FILE NAME ▒▒ ";:GOSUB2340:REM ** KEYBOARD INPUT **
1540 N$=I8$:PRINT
1550 GOSUB 2470:REM *LINE
1560 PRINT"HOW MANY COLUMNS IN EACH RECORD ▒▒ ";:GOSUB2340
1570 X=VAL(I8$) PRINT
1580 IFX<1ORX>10THENPRINT"■AXIMUM IS 10■":GOTO1560
1590 PRINTCHR$(147):C=1
1600 PRINT"     ■THIS FILE IS NAMED "N$    :GOSUB2470
1610 PRINT"REMEMBER THAT COLUMN 1 IS THE ■EY FIELD■":PRINT
1620 PRINT"WHICH WILL BE USED TO ■IDENTIFY■ RECORD":GOSUB2470
1630 PRINT"STATE ■TITLE■ OF COL"C" ▒▒";:
1640 GOSUB2340    :REM * KEYBOARD INPUT
1650 A$(0,C)=I8$:PRINT
```

Program Listing

```
QUOTES  = $00       In quotes flag
NEXTLN  = $01       Pointer to next BASIC line
PTR     = $0F       Text pointer
TXTST   = $28       Start of BASIC program
                    pointer
HIMEM   = $34       Top of RAM
LENFN   = $D1       Length of file name
LOGFL   = $D2       Logical file number
SECAD   = $D3       Secondary address
DEVICE  = $D4       Device number — Printer = 4
BEGIN   = $7530     Start of lister: SYS 30000
PRTLN   = $DCD9     Prints a decimal number
                    <65536
OPEN    = $F524     Open file
SETOUT  = $F7BC     Set output device
RESTOR  = $F272     Restore all I/O
CLOSE   = $F2AC     Close file
STOP    = $F301     Test STOP key
SPACE   = $FDCD     Print a space
CRLF    = $FDD0     Print (CR) (LF)
PRINT   = $FFD2     Print ASCII character
BASIC   = $C092     Table of BASIC keywords

7530  A5 30        LDA <BEGIN      Set top of memory pointer to
7532  85 34        STA HIMEM       Protect lister from being
                                  corrupted
7534  A5 75        LDA >BEGIN
7536  85 35        STA HIMEM+1
7538  A9 00        LDA #0
753A  85 D1        STA LENFN       No file name for Printer
753C  85 D3        STA SECAD       No secondary address needed
753E  A9 04        LDA #4
7540  85 D2        STA LOGFL
7542  85 D4        STA DEVICE
7544  20 24 F5     JSR OPEN        Open file to Printer : OPEN 4,4
7547  A6 D2        LDX LOGFL
7549  20 BC F7     JSR SETOUT      Set output device to Printer
754C  A5 28        LDA TXTST
754E  A6 29        LDX TXTST+1     Start of BASIC program
                                  pointers
7550  85 0F  NEWLIN STA PTR        Set lister pointer to
7552  86 10        STX PTR+1       Start of next line
7554  20 70 75     JSR LAST        Save pointer to next line
7557  85 01        STA NEXTLN
7559  20 6A 75     JSR NEXT
755C  85 02        STA NEXTLN+1
755E  D0 15        BNE MOR100      Must be more lines to follow
7560  20 D0 FD  FINISH JSR CRLF    Terminate listing
7563  20 72 F2     JSR RESTOR      Restore output device to
                                  screen
7566  20 AC F2     JSR CLOSE       Close file, then
7569  60           RTS             Return to BASIC
756A  E6 0F  NEXT  INC PTR         Subroutine to get
756C  D0 02        BNE LAST        Next character from
756E  E6 10        INC PTR+1       BASIC text
7570  A0 00  LAST  LDY #0
7572  B1 0F        LDA (PTR),Y     PTR is pointer to actual text
7574  60           RTS
7575  20 01 F3  MOR100 JSR STOP    STOP key pressed?
7578  F0 E6        BEQ FINISH      Yes — terminate listing
757A  A9 00        LDA #0          Beginning of line so no quotes
757C  85 00        STA QUOTES
757E  20 6A 75     JSR NEXT        Get line number
7581  AA           TAX             Store high byte
7582  20 6A 75     JSR NEXT        Get low byte
7585  EA           NOP
7586  EA           NOP
7587  20 D9 DC     JSR PRTLN       Print line number in decimal
758A  20 CD FD     JSR SPACE       Leave a space
758D  A9 00  EXTRA LDA #0          Change to LDA #32 if spacing
758F  20 D2 FF  PRT JSR PRINT      Between keywords is required
7592  20 6A 75     JSR NEXT        Get next character
7595  D0 0A        BNE MOR200      Not end of line
7597  20 D0 FD     JSR CRLF        Go on to next printer line
759A  A5 01        LDA NEXTLN      Use stored pointer to
759C  A6 02        LDX NEXTLN+1    Get next line
759E  4C 50 75     JMP NEWLIN      Go back
75A1  C9 22  MOR200 CMP #'"'       Quotes?
75A3  D0 08        BNE NOTQUT      No — go on
75A5  A5 00        LDA QUOTES      Reverse quotes flag
75A7  49 01        EOR #1
75A9  85 00        STA QUOTES
75AB  A9 22        LDA #'"'        Restore accumulator value
75AD  A6 00  NOTQUT LDX QUOTES
75AF  D0 27        BNE INQUOT      Text is in quotes
75B1  AA           TAX
75B2  10 DB        BPL PRT         Not a keyword token
75B4  C9 FF        CMP #$FF        Check for PI symbol
75B6  F0 D7        BEQ PRT         Yes — do normal print
75B8  29 7F        AND #$7F        Drop bit 7
75BA  A0 FF        LDY #$FF
75BC  AA           TAX
75BD  F0 09        BEQ FOUND       Must be 'END' token
75BF  C8     CYCLE INY
75C0  B9 92 C0     LDA BASIC,Y     Cycle through all characters
75C3  10 FA        BPL CYCLE       Of a keyword
75C5  CA           DEX
75C6  D0 F7        BNE CYCLE       Go back if wrong word
75C8  C8     FOUND INY             Found correct keyword
75C9  B9 92 C0     LDA BASIC,Y     Print keyword in full
75CC  08           PHP
75CD  29 7F        AND #$7F        Print unshifted characters
75CF  20 D2 FF     JSR PRINT
75D2  28           PLP
75D3  10 F3        BPL FOUND       Do rest of characters in word
75D5  4C 8D 75     JMP EXTRA       Go back for next CHR from
                                  text
75D8  C9 22  INQUOT CMP #'"'       Quotes to end text?
75DA  F0 B3        BEQ PRT         Yes — go back
75DC  C9 80        CMP #$80
75DE  B0 04        BCS CHECK       A shifted character
75E0  C9 20        CMP #$20
75E2  B0 AB        BCS PRT         Not a control/shifted CHR
75E4  A9 5B  CHECK LDA #'['        Print a square bracket: '['
75E6  20 D2 FF     JSR PRINT
75E9  20 70 75     JSR LAST        Get last CHR
75EC  A0 07        LDY #7
75EE  D9 13 76  SEARCH CMP KEYCHR,Y Try and match it
75F1  F0 0D        BEQ YES         Yes — found it
75F3  88           DEY
75F4  10 F8        BPL SEARCH      Try next one
75F6  29 7F        AND #$7F        Must be just a shifted graphic
75F8  20 D2 FF     JSR PRINT       Print it
75FB  A9 5D  SQCLOS LDA #']'       Close brackets
75FD  4C 8F 75     JMP PRT
7600  BE 1B 76  YES LDX OFFSET,Y   Offset for replacement text
7603  E8     MOR400 INX
7604  BD 23 76     LDA NEWCHR,X    Table of replacement CHRs
7607  08           PHP
7608  29 7F        AND #$7F        Print replacement text
760A  20 D2 FF     JSR PRINT
760D  28           PLP
760E  10 F3        BPL MOR400      More CHRs
7610  4C FB 75     JMP SQCLOS      Close brackets, etc.
7613  11     KEYCHR .BYT $11,$1D,$91,$9D  Table of control
7614  1D
7615  91
7616  9D
7617  93           .BYT $93,$13,$12,$92  Characters to change
7618  13
7619  12
761A  92
761B  FF     OFFSET .BYT $FF,$01,$03,$05  Offsets to 'NEWCHR'
761C  01
761D  03
761E  05
761F  07           .BYT $07,$0A,$0E,$11  Table
7620  0A
7621  0E
7622  11
7623  43     NEWCHR .BYT 'C',$C4      'CURSOR DOWN'
7624  C4
7625  43           .BYT 'C',$D2      'CURSOR RIGHT'
7626  D2
7627  43           .BYT 'C',$D5      'CURSOR UP'
7628  D5
7629  43           .BYT 'C',$CC      'CURSOR LEFT'
762A  CC
762B  43 4C        .BYT 'C',$D3      'CLEAR SCREEN'
762D  D3
762E  48 4F 4D     .BYT 'HOM',$C5    'HOME CURSOR'
7631  C5
7632  52 56        .BYT 'RV',$D3     'REVERSE FIELD'
7634  D3
7635  4F 46        .BYT 'OF',$C6     'OFF REVERSE'
7637  C6
7638  00           .BYT $00,$00,$00  End of table
7639  00
763A  00
763B               END
```

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This RAM pack and the replacement ROM are described below. And the description of each cassette makes it clear what hardware is required.

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Cassette 1 – Games

For ZX81 (and ZX80 with 8K BASIC ROM)

ORBIT – your space craft's mission is to pick up a very valuable cargo that's in orbit around a star.

SNIPER – you're surrounded by 40 of the enemy. How quickly can you spot and shoot them when they appear?

METEORS – your starship is cruising through space when you meet a meteor storm. How long can you dodge the deadly danger?

LIFE – J. H. Conway's 'Game of Life' has achieved tremendous popularity in the computing world. Study the life, death and evolution patterns of cells.

WOLFPACK – your naval destroyer is on a submarine hunt. The depth charges are armed, but must be fired with precision.

GOLF – what's your handicap? It's a tricky course but you control the strength of your shots.

Cassette 2 – Junior Education: 7-11-year-olds

For ZX81 with 16K RAM pack

CRASH – simple addition – with the added attraction of a car crash if you get it wrong.

MULTIPLY – long multiplication with five levels of difficulty. If the answer's wrong – the solution is explained.

TRAIN – multiplication tests against the computer. The winner's train reaches the station first.

FRACTIONS – fractions explained at three levels of difficulty. A ten-question test completes the program.

ADDSUB – addition and subtraction with three levels of difficulty. Again, wrong answers are followed by an explanation.

DIVISION – with five levels of difficulty. Mistakes are explained graphically, and a running score is displayed.

SPELLING – up to 500 words over five levels of difficulty. You can even change the words yourself.

Cassette 3 – Business and Household

For ZX81 (and ZX80 with 8K BASIC ROM) with 16K RAM pack

TELEPHONE – set up your own computerised telephone directory and address book. Changes, additions and deletions of up to 50 entries are easy.

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For ZX81 (and ZX80 with 8K BASIC ROM) and 16K RAM pack

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TWENTYONE – a dice version of Blackjack.

COMBAT – you're on a suicide space mission. You have only 12 missiles but the aliens have unlimited strength. Can you take 12 of them with you?

SUBSTRIKE – on patrol, your frigate detects a pack of 10 enemy subs. Can you depth-charge them before they torpedo you?

CODEBREAKER – the computer thinks of a 4-digit number which you have to guess in up to 10 tries. The logical approach is best!

MAYDAY – in answer to a distress call, you've narrowed down the search area to 343 cubic kilometers of deep space. Can you find the astronaut before his life-support system fails in 10 hours time?

Cassette 5 – Junior Education: 9-11-year-olds

For ZX81 (and ZX80 with 8K BASIC ROM)

MATHS – tests arithmetic with three levels of difficulty, and gives your score out of 10.

BALANCE – tests understanding of levers/fulcrum theory with a series of graphic examples.

VOLUMES – 'yes' or 'no' answers from the computer to a series of cube volume calculations.

AVERAGES – what's the average height of your class? The average shoe size of your family? The average pocket money of your friends? The computer plots a bar chart, and distinguishes MEAN from MEDIAN.

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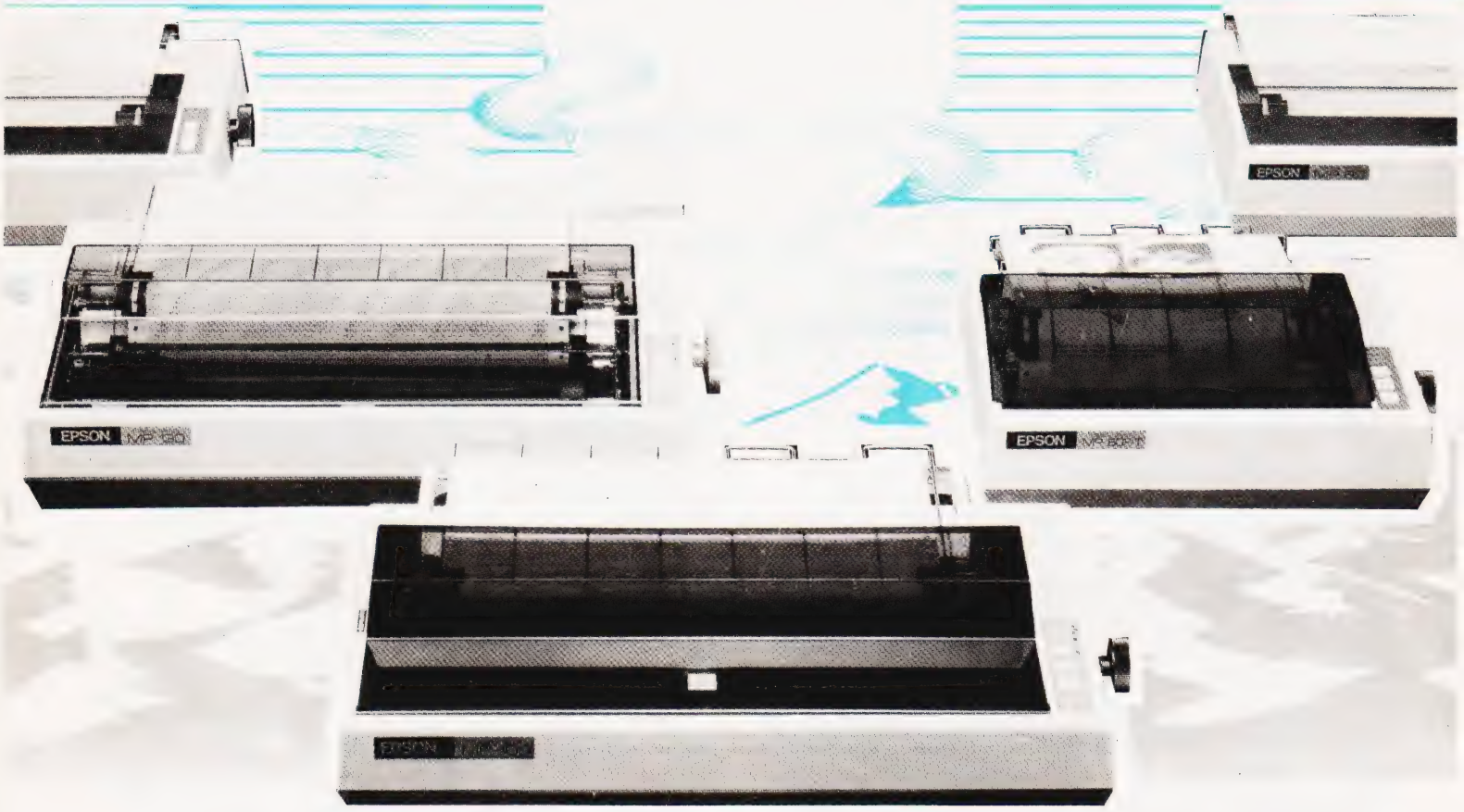

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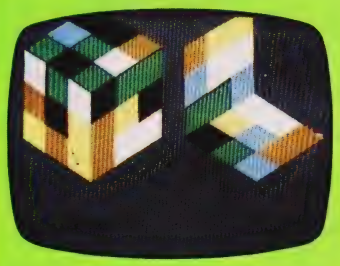

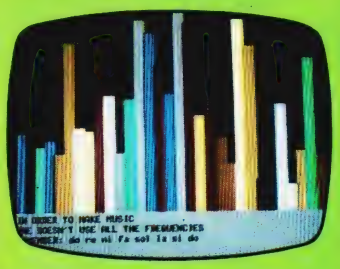

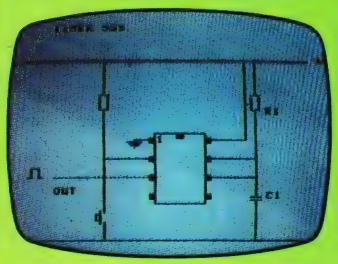

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MY INTEREST IS:

D S Peckett

Basing your predictions of football results on recent form certainly seems to be a winning method.

Once you've actually bought a personal computer, the problem sometimes arises of what to do with it — how do you justify it to your nearest and dearest? Saving menus is all very well, but it's usually quicker and simpler to look them up in books.

This is the first of two articles that will describe a way of using a computer to win the football pools. Actually, it does not *guarantee* wins every week, but it will improve your chances of winning. It's the sort of microcomputer application that has the knack of silencing the opposition!

The program runs in a 16K TRS-80 or Video Genie, and manipulates a data base, formed from the results of many matches, in an attempt to predict the most likely draws each week. It is based on an article which appeared in 'New Scientist' (see reference) and if you want to know more about its background, I urge you to dig a copy of that article out of your local library. In this article I will describe the program's basic philosophy and the things that it has to do. Next month I'll give a BASIC listing for the program and explain how to use it.

Prediction Method

There are as many ways of predicting pools results as there are punters. Some give forecasts that are consistently better than picking the matches with a pin, while others are no better than random number generators.

The key point to understand from the start is that there is no 'best' way of winning the pools, but the advantages of a computer in this sort of business is that it can handle vast masses of data. That allows us to do two things which would be impractical any other way. We can use forecasting methods that analyse the masses of data, and we can try out lots of different prediction methods to find one that seems to have promise.

The starting point is to choose a forecasting method. For instance, you might feel that matches in which the home team's name starts with 'N' to 'Z', and which are refereed by a man born south of Watford, will always be draws. Providing that your data base is properly structured, you can set your computer to analysing lots of matches to see if this hypothesis works. You may even find that it does!

I think, though, that the assumption made by my program is a little more reasonable. It is that a match's result is strongly affected by both of the teams' recent form. By recent form I mean the results of the last couple of matches.

Having originally made this assumption, and at that stage it was only an assumption, I had to collect the results of lots of matches to see if there was anything in it. My data base now has two season's worth of results in it (around 3800 matches) and it is not too difficult to see whether or not my original hypothesis was correct.

If we look at some examples we'll see that it does appear to work. The examples are actually for teams playing in the normal home — away — home —

away sequence, although my data base is not limited to such teams.

First of all, suppose that the home team won its last home match and drew its last away, while the away team lost its last away match and drew last week at home. A draw sounds unlikely in this sort of case — a home win might be a better bet — and the data base confirms that the chance of a draw is only around 16%.

On the other hand, if the home team drew last time it played at home and lost away, and the away team won its last two matches, the probability of a draw leaps to 35%. Again, this sounds reasonable.

To put these figures into perspective, over the last two seasons just under 28% of all matches have been draws. Thus, if you pick eight matches at random you can expect slightly more than two of them to be draws.

There are also some surprises. For instance, I have a record of six matches in which both teams had drawn their last two matches. Make what you will of the fact that none of the six results were draws.

A detailed study of the data base shows that the 'recent form' hypothesis really does have merits. Certain combinations of form are much more likely to produce draws than others. On its own, this is not a very earth-shattering conclusion, but it is one that is made for computer analysis. Using a computer lets us pick out the most likely combinations with far more confidence than by using experience on its own. Being able to analyse a lot of data very quickly makes all the difference in this game.

The pools program, then, works on the basis of looking at the performance of each team in its last two matches. The form of the two teams in a match is then used to discover how many matches with similar form have produced draws in the past. This approach dictates the shape of the data base that the program needs.

Each of a team's last two matches could have been at home or away, and it could have won, drawn or lost either of those matches. A single result can therefore have one of six values: HW, HD, HL, AW, AD or AL. Since we are looking at a team's form over two matches, we need to be able to code it with any one of 36 values.

In fact, the program codes form on a points basis, with HW, HD, HL, AW, AD and AL being awarded 0, 1, 2, 3, 4 and 5 points respectively. The form over the last two matches is saved by multiplying the points for the first match by 6 and adding those for the second. Thus a HW, AD record is coded as 4, while AL, HL emerges as 32.

This suggests the basic shape of the data base — two teams per match, 36 possible form values (0-35) for each team — a 36x36 matrix. Remember, we are not trying to follow matches between specific teams but we are tracking matches between teams of known recent form.

What must be stored in the data base? Ideally, we would keep a record of the number of no-score draws, score draws, home wins and away wins for each combination of form. Add up the four items and you get the total number of matches. With this sort of detail, we could predict anything.

Unfortunately, the program has to fit into a 16K computer! Since the TRS-80 and Video Genie, like most micros, store an integer in two bytes, a full data base would take up 36x36x4x2, that's 10368 bytes. This would leave no room for the program, let alone all the other items of data we will need, such as the record of each team's name and its recent form.

The way around this problem was to concentrate only on draws, without even being able to tell 'score' from 'no-score'. The program limits itself to saving the number of draws, and the total number of matches, for each of the 36x36 form combinations. Even with this compromise, there is still only room for one 36x36 integer array, which has to hold the two sets of data. The 'draws' and 'all matches' totals are each squeezed into a single byte of the two bytes that the computer allocates to each cell of the array.

Predicting The Draws

It now sounds easy to get the probability (P) of any matches resulting in a draw. Simply read the number of draws (D) and the total number of matches (N) for that combination of form and:

$$P = D/N$$

Inevitably, it's not quite as easy as that. In particular, the prediction is very poor when N is small. For instance, suppose that there is only one match on record for a given form-pair, and that was a draw. That gives us:

$$P = 1/1 = 1$$

In other words, the match is certain to be a draw.

That does not sound right. The way out is to form a 'weighted average' of the predicted value and the probability of a draw if we did not know anything about the match. You'll remember that the overall chance of a draw is around 28%, but let's call it 25% (or ¼) to make the sums easier. 'Weighting' means that the more matches there are in the sample, the more notice the program should take of them and the less attention it should pay to the 25% figure.

There are lots of ways of producing a weighted average, but I chose to use an inverse exponential curve; Fig. 1 shows its effect. The predictions from the data base and from '25%' are mixed together so that, with only one match in the data base, they have roughly equal weight, and with lots of matches the program virtually ignores the 25%.

The sums to do this are easy for a computer. It has to generate the weighting factor (P3) as:

$$P3 = EXP(-N/KW)/2$$

That is the basic equation of the curve in

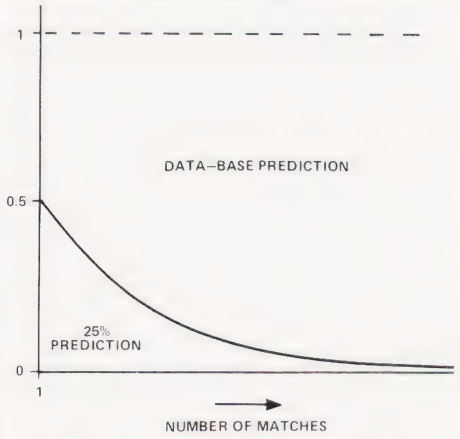

Fig. 1 The curve produced by the weighted average equation.

Fig. 1. 'KW' is a fiddle-factor which makes the curve fall off at the proper rate — after a lot of experiments, I found that a value of 15 is about right.

Once P3 has been calculated, the overall probability of a draw becomes:

$$P = (1 - P3)*(N/D) + P3/4$$

As N increases, P3 becomes very small, and P gets closer and closer to the original '(N/D)'.

To see the effect of these equations, think about two sets of data; the first has one draw out of one match, the second has 20 draws out of 20 matches. Obviously, in each case:

$$N/D = 1$$

But if we weight the predictions, then the first example gives a 65% chance of a draw, while the second suggests a 90% chance. That sounds much more reasonable.

Even now, we are not finished. Although the prediction is based on the teams' recent form, we can't ignore long-term form altogether. The best way of getting this is to look at the teams' positions in the League. The program must allow for the fact that, say, a top of the table team playing at home against one from the bottom of the table is likely to win at home. The chance of a draw is correspondingly reduced.

The program gets around this by recording the approximate league position of a team as one of three categories — top quarter, middle and bottom quarter. The splits are not critical, but those proportions give good results.

The three categories are assigned position values of 1, 2 and 3 respectively. By subtracting the away team's position code from that of the home team, we can get their relative league positions. A value of '2' means a top of the league club playing away to a straggler, while '−2' has that strong club at home to the weak one. Clearly, there are 5 possible categories: −2, −1, 0, 1, 2.

Each category has a weighting factor (Q) associated with it, and Q is used to adjust the value of P we calculated a few lines ago. The values of Q which I recommend are shown in Table 1. After a lot of trials, these have given the best chances of predicting draws, but if you want to experiment they are very easy to change.

Let's go back to the 20-match sample we had earlier, which gave a 90% chance of a draw. Suppose the home team is from the middle of the table, while the away team is near the top. This gives a relative league position of '1', and a final draw probability of:

$$90 \times 1.3 = 117\%$$

Before all you statisticians write in to me, I know perfectly well that probabilities cannot be greater than unity. We are not, in fact, calculating probability any more, but providing numbers which the program can use to rank matches in order of the likelihood of their producing a draw. The actual numbers are not that important. If it's any consolation, it is very unusual for the program actually to generate a 'probability' that is greater than 1.

That, then, is the basic idea behind the program — to identify the recent form of the two teams in a match and then, on the basis of a record of previous matches with that form, to predict the chance of a draw this time around. However, what does the program actually have to do in order to support this task?

Program Tasks

The program's fundamental job, of course, is the ranking of the matches in order of draw probability. To use in conjunction with the main data base, the program must have a record of each team's league position and its current form, stored as the integer values 1-3 and 0-35 respectively.

I found it best to leave out the Scottish Second Divison! The early versions of the program included it, but it soon became clear that it was not worthwhile for two reasons:

a) The Division's matches are not often on the pools coupon.

b) The results follow laws known only to themselves — the program's methods do not work.

The team data is therefore stored as a 6x24 matrix which allows one row per division and 24 columns to accommodate the 24 teams of the Third and Fourth Divisions.

Before it can predict the draws, the program must know what matches are to be played and it uses a menu approach to generate a match list. The list is held as a 6x12x2 matrix six rows for the six divisions, and 12 columns for the maximum of 12 matches per division. One layer of the matrix holds the identity of the two teams in a match, while the second layer holds the computed probability of the match being a draw.

Once the matches have been played, their results must be used to modify the team records and to expand the main data base. The program therefore contains routines to input the result of each match. This result updates all the main data, but does *not* affect the League positions.

A separate routine is provided to adjust the League positions without affecting any other data. In practice, you will find that, once the season is properly under way (say two months), you will only need to change the league tables every three or four weeks.

It is not worth trying to use the program in the first weeks of a season, because the teams take that amount of time to settle down. Once they have, their most recent form must be supplied to the program before it can be used. There is a procedure to do just this, but you are only likely to need it once a year.

```
MOST LIKELY DRAWS:

1.   AIRDRIE        VS   MORTON          Ø.6169   5
2.   DUMBARTON      VS   DUNFERMLINE     Ø.6117   7
2.   LINCOLN        VS   GILLINGHAM      Ø.4543   1
4.   SHREWSBURY     VS   QPR             Ø.45ØØ   5
5.   WALSALL        VS   BRISTOL ROV.    Ø.4392   29
6.   NEWCASTLE      VS   BOLTON          Ø.39Ø6   2
7.   SWINDON        VS   WIMBLEDON       Ø.3839   3
8.   YORK           VS   BOURNEMOUTH     Ø.3889   3
9.   CARDIFF        VS   DERBY           Ø.3462   5
10.  ROCHDALE       VS   TRANMERE        Ø.3462   5
11.  DARLINGTON     VS   ALDERSHOT       Ø.3359   6
12.  SOUTHAMPTON    VS   MAN. CITY       Ø.3248   8Ø
13.  HAMILTON       VS   E. STIRLING     Ø.3180   15
14.  BURNLEY        VS   PLYMOUTH        Ø.2771   3
```

Fig. 2 Some typical results produced by the program which will appear in next month's issue.

You will have realised by now that the program is useless without its record of drawn matches, and so we must be able to create this data base in the first place. In practice, I found that the program needs at least a season's worth of results (about 1900 matches) before it is any use.

One way to set that data up is to create a match list for each week and then to put in the results in the normal way. This would use the routines that the program has to have anyway. I soon found, however, that this approach made a tedious job even more tedious. The program therefore includes an option to enter a match's result as soon as the match has been defined. This facility speeds up the essential job of creating the data base, but it still takes a long time.

Finally, the data base has to be saved from week to week. The program has to transfer all the significant data (the main array, the teams' form and the match list) to cassette, and to read it in again. It also provides the option of verifying that data has been read from, or written to, the tape correctly. With the poor reliability of cassettes, and the vital importance of keeping the data uncorrupted, you would have to be very brave to skip the verification stage.

Conclusion

In this article I have introduced a program which I have written and used successfully to help win the football pools.

The program grew from a 'New Scientist' article, and works on the basis of looking at the recent form of the teams in each match and seeing what happened before when any teams with a similar record played. It performs the sort of detailed, methodical analysis that would be impossible without a computer.

Because the program is written to fit into 16K it can only handle draws, and cannot tell the difference between the 'score' and 'no-score' varieties. Nevertheless, it manages to do around 20-25% better than picking the matches with a pin.

I do not guarantee that it will make money for you nor, indeed, that it will always do better than choosing matches at random — you must expect setbacks from time to time. However, if you use it every week, and keep the data base current, you will significantly improve your chances of winning small dividends. A methodical technique like this has no chance of scooping the jackpot, which relies on the unexpected happening.

I've outlined all the facilities which the program offers, and indicated vaguely how it actually provides them. Next month I will give you a listing for the program and explain in detail how to use it.

Until then, you may be interested in Fig. 2, which shows a typical example of the program's output. It lists, in descending order, the 14 most likely draws and gives the 'probability' of each one. The right-hand column shows how many previous matches each prediction is based on — the more matches there are, the more confidence you can have in the prediction.

Reference

(1) George, Frank. 'A Challenge to Win the Pools'. New Scientist, 20 March 1980, p 910.

Relative League Position	Weight
−2	0.4
−1	0.7
0	1.0
1	1.3
2	1.1

Table 1. Effect of Relative League Position.

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COLOUR CUBE

Dave Collier

Last month's cover illustrates the graphics capabilities of the DAI, this program shows how easy it was to produce.

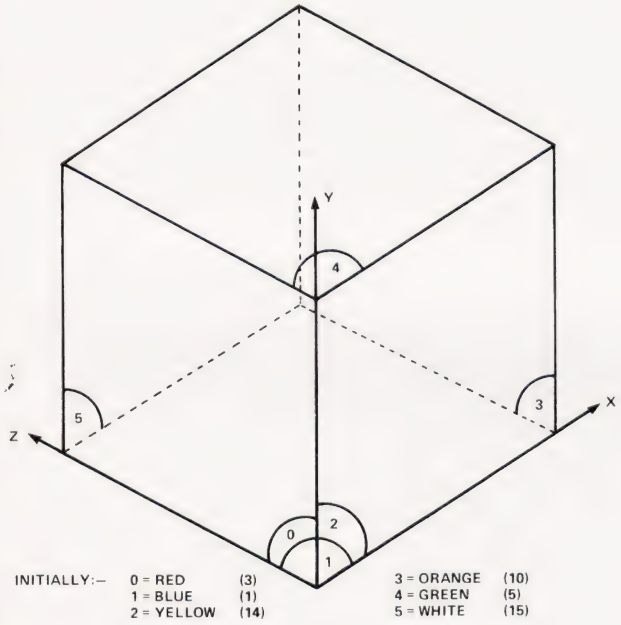
We're giving away our secrets by publishing this program — it is the one used to generate last month's front cover pictures on the DAI. Written for us by their resident programming genius, Dave Collier, it gives an insight into the power of the BASIC and colour graphics commands that the system has built-in.

No apologies are made for the lack of documentation as this is not supposed to be more than a demonstration, but there are REMs for all the important bits and the diagram shows the way in which the faces are numbered.

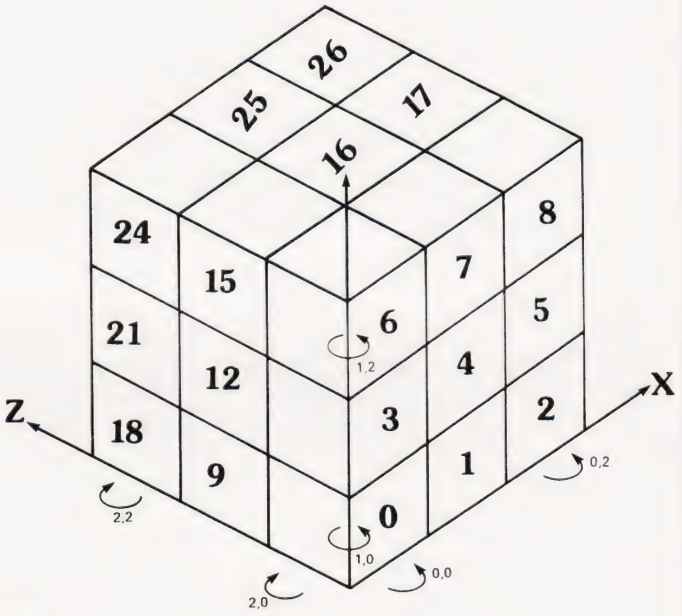
It is quite simple to make the program operate manually by INPUTting the J and K co-ordinates at line 1020 instead of having them randomly determined. The program is designed to allow only legal moves so the only checking that needs to be done is to ensure that the numbers are in the range 0 to 2.

The program has been prepared on a high quality printer. We've now got a new daisy wheel which prints zeros with the line through them — another source of confusion removed!

All we need now is to get rid of the human element . . .



(1)



(2)

Program Listing

```
5       CLEAR 15000
10      NCUBE=3*3*3
20      DIM POSN(2,2,2)
21      REM**HOLDS CUBE # AT EACH POINT
30      DIM FACE(NCUBE-1,6-1)
31      REM**COLOURS OF FACES OF EACH CUBE
100     XV=0:YV=1:ZV=1:K=0
110     GOSUB 200:REM**COLOUR FACES 0,3
120     XV=1:YV=0:ZV=1:K=1
130     GOSUB 200:REM**FACES 1,4
140     XV=1:YV=1:ZV=0:K=2
150     GOSUB 200:REM**FACES 2,5
160     GOTO 400
200     FOR X=0 TO 2*XV
210     FOR Y=0 TO 2*YV
220     FOR Z=0 TO 2*ZV
230     FACE(X+Y*3+Z*9,K)=K+1
240     X1=X+2*(1-XV)
250     Y1=Y+2*(1-YV)
260     Z1=Z+2*(1-ZV)
270     FACE(X1+Y1*3+Z1*9,K+3)=K+1+3
280     NEXT Z
290     NEXT Y
300     NEXT X
310     RETURN
400     REM**SET INITIAL CUBE NUMBERS
410     FOR X=0 TO 2
420     FOR Y=0 TO 2
430     FOR Z=0 TO 2
440     POSN(X,Y,Z)=X+Y*3+Z*9
441     REM**EACH POSITION HOLDS ITS OWN CUBE
450     NEXT Z
460     NEXT Y
470     NEXT X
500     REM**SET UP ACTUAL COLOURS CORRESPONDING
501     REM**TO COLOUR NUMBERS 1 TO 6
510     DIM COL(6)
520     DATA 3,1,14,10,5,15
530     REM**RED BLUE YELLOW ORANGE GREEN WHITE
540     FOR K=1 TO 6
550     READ COL(K)
560     NEXT K
600     REM**THIS TABLE GIVES X+Y OFFSETS
601     REM**FOR THE FOUR CORNER CUBES
610     DIM V(3,2,1)
620     DATA 0,0,0
630     DATA 0,2,0
640     DATA 0,2,2
```

```
650     DATA 0,0,2
660     FOR Q=0 TO 3:FOR V=0 TO 2
670     READ V(Q,V,0)
680     NEXT V:NEXT Q
700     REM**THIS TABLE GIVES OFFSETS FOR
701     REM**THE FOUR EDGE CUBES
710     DATA 0,1,0
720     DATA 0,2,1
730     DATA 0,1,2
740     DATA 0,0,1
750     FOR Q=0 TO 3:FOR V=0 TO 2
760     READ V(Q,V,1)
770     NEXT V:NEXT Q
800     REM**THIS TABLE GIVES SIDE SEQUENCES
801     REM**FOR ROTATION IN THE
        THREE DIRECTIONS
810     DIM VF(3,2)
820     DATA 2,2,1
830     DATA 4,0,3
840     DATA 5,5,4
850     DATA 1,3,0
860     FOR Q=0 TO 3:FOR V=0 TO 2
870     READ VF(Q,V)
880     NEXT V:NEXT Q
1000    REM**THIS SECTION CONTROLS WHAT THE
1001    REM**PROGRAM DOES
1010    GOSUB 50000
1015    WAIT TIME 1000
1020    J=RND(3):K=2*INT(RND(2))
1021    REM**RANDOM MOVES
1030    GOSUB 10000:REM**MOVE CUBES
1040    GOTO 1010
10000   REM**ENTRYPOINT TO MOVE CUBES
10001   REM**PARAMETERS J AND K
10002   REM**J DEFINES AXIS OF
        ROTATION - 0 TO 2
10003   REM**K DEFINES WHICH OF THE
        PLANES - 0 TO 2
10010   X=0:Y=0:Z=0
10020   IF J=0 THEN X=K:XV=0:YV=1:ZV=2
10030   IF J=1 THEN Y=K:XV=2:YV=0:ZV=1
10040   IF J=2 THEN Z=K:XV=1:YV=2:ZV=0
10100   FOR R=0 TO 1:REM**CORNERS+EDGES
10110   XT=X+V(0,XV,R)
10111   YT=Y+V(0,YV,R):ZT=Z+V(0,ZV,R)
10112   PTEMP=POSN(XT,YT,ZT)
10120   FOR Q=0 TO 2
10130   XT=X+V(Q+1,XV,R)
10131   YT=Y+V(Q+1,YV,R):ZT=Z+V(Q+1,ZV,R)
10132   TEMP=POSN(XT,YT,ZT)
10140   XT=X+V(Q,XV,R)
10141   YT=Y+V(Q,YV,R):ZT=Z+V(Q,ZV,R)
10142   POSN(XT,YT,ZT)=TEMP
10150   NEXT Q
10160   XT=X+V(3,XV,R)
10161   YT=Y+V(3,YV,R):ZT=Z+V(3,ZV,R)
10162   POSN(XT,YT,ZT)=PTEMP
10170   NEXT R
10200   REM**NOW ROTATE ALL CUBES IN PLANE
10210   XV=SGN(XV):YV=SGN(YV):ZV=SGN(ZV)
10220   IF XV<>0 THEN FOR X=0 TO 2*XV
10230   IF YV<>0 THEN FOR Y=0 TO 2*YV
10240   IF ZV<>0 THEN FOR Z=0 TO 2*ZV
10250   C=POSN(X,Y,Z)
10260   VT=VF(0,J):FTEMP=FACE(C,VT)
10270   FOR Q=0 TO 2
10280   VT=VF(Q+1,J):TEMP=FACE(C,VT)
10290   VT=VF(Q,J):FACE(C,VT)=TEMP
10300   NEXT Q
10310   VT=VF(3,J):FACE(C,VT)=FTEMP
10320   IF ZV<>0 THEN NEXT Z
10330   IF YV<>0 THEN NEXT Y
10340   IF XV<>0 THEN NEXT X
10350   RETURN
50000   REM**DRAW THE CUBE
50005   COLORG 4 0 0 0:REM**SET
        BACKGROUND COLOUR
50010   MODE 5:MODE 5:REM**CLEAR SCREEN
50100   L=32
50110   LB2=L/2
50111   REM**HALF LONG SIDE OF CUBE XMAX/16
50120   LR2=24
50121   REM**ROUGHLY L/SQR(2) BUT ALSO 0 MOD 80
50130   FOR VIEW=0 TO 1:REM**DRAW 2 VIEWS
50200   XM=(XMAX+1)/2-(3.5-VIEW*7)*LR2
50201   XM=(XM+4)-(XM+4) MOD 8:YM=YMAX/2
50202   REM**FIND CENTRE OF EACH VIEW
50210   GOSUB 51000
50220   GOSUB 52000
50230   GOSUB 53000
50300   NEXT VIEW
50999   RETURN
51000   REM**DRAW TOP/BOTTOM
51010   FOR FX=0 TO 2
51020   FOR FZ=0 TO 2
51030   XC=XM+(FX-FZ)*LR2
51040   YC=YM+(1+FX+FZ)*LB2-VIEW*LB2*6
51050   GOSUB 61000
51060   NEXT FZ
51070   NEXT FX
51080   RETURN
52000   REM**DRAW FACES 2/5
52010   FOR FX=0 TO 2
52015   FOR FY=0 TO 2
52020   XC=XM+LR2*FX-VIEW*LR2*3
52021   REM**X SCREEN POSN OF FACE
52025   YC=YM-L*(2-FY)+FX*LB2+VIEW*LB2*3
52026   REM**X AND Y POSN
52030   GOSUB 62000
52050   NEXT FY
52060   NEXT FX
52070   RETURN
53000   REM** DRAW FACES 0/3
53010   FOR FY=0 TO 2
53020   FOR FZ=0 TO 2
53030   XC=XM-LR2*FZ+VIEW*LR2*3
53040   YC=YM-L*(2-FY)+FZ*LB2+VIEW*LB2*3
53050   GOSUB 63000
53060   NEXT FZ
53070   NEXT FY
53080   RETURN
61000   REM**DRAW A TOP/BOTTOM FACET
61010   C=COL(FACE(POSN(FX,2*(1-VIEW),FZ),
        1+3*(1-VIEW)))
61100   FOR Y=YC-LB2 TO YC+LB2-1
61110   T=LR2-ABS(Y-YC)*LR2/LB2
61120   DRAW XC-T,Y XC+T,Y C
61130   NEXT Y
61999   RETURN
62000   REM**DRAW FACETS 2/5
62010   C=COL(FACE(POSN(FX,FY,2*VIEW),2+VIEW*3))
62011   REM**LOOK UP ITS COLOUR
62100   FOR Y=YC-L TO YC-LB2-1
62110   DRAW XC,Y XC+(LR2-1)*(Y-(YC-L))/LB2,Y C
62120   NEXT Y
62200   FOR Y=YC-LB2 TO YC-1
62210   DRAW XC,Y XC+LR2-1,Y C
62220   NEXT Y
62300   FOR Y=YC TO YC+LB2-1
62310   DRAW XC+(Y-YC)*LR2/LB2,Y XC+LR2-1,Y C
62320   NEXT Y
62499   RETURN
63000   REM**DRAW FACETS 0/3
63010   C=COL(FACE(POSN(2*VIEW,FY,FZ),0+VIEW*3))
63100   FOR Y=YC-L TO YC-LB2-1
63110   DRAW XC-1,Y XC-(LR2-1)*(Y-(YC-L))
        /LB2-1,Y C
63120   NEXT Y
63200   FOR Y=YC-LB2 TO YC-1
63210   DRAW XC-1,Y XC-(LR2-1)-1,Y C
63220   NEXT Y
63300   FOR Y=YC TO YC+LB2-1
63310   DRAW XC-(Y-YC)*LR2/LB2-1,
        Y XC-(LR2-1)-1,Y C
63320   NEXT Y
63999   RETURN
```

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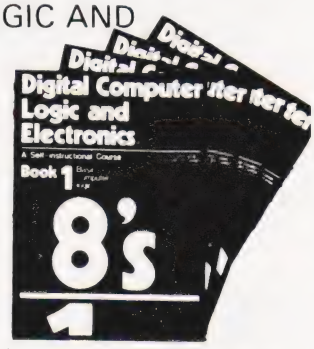

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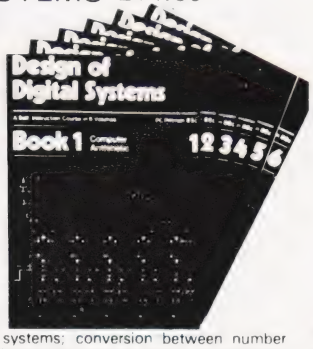

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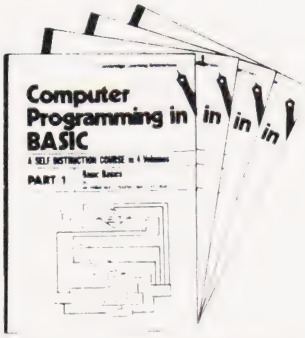

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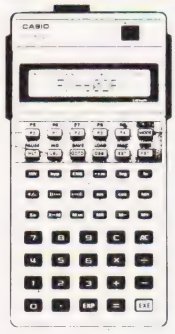

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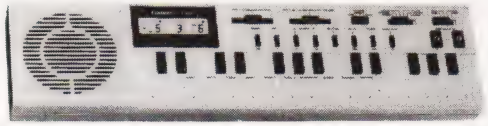

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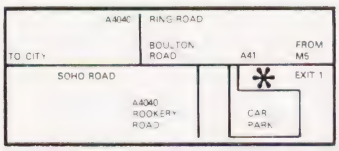

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S M Gee and Pete Sneddon

Our staple offering this month is a set of books on the BASIC language

All the books reviewed this month approach, in one way or another, the problem of how to communicate with a computer. English is a non-starter as a computing language because of its ambiguity — only a human being is able to understand what is meant by 'times flies' — so programming languages have, therefore, been developed. These are restricted, well defined and entirely unambiguous subsets of the English language (which is fine if you start off as a fluent English languge speaker, but is just another problem if you don't!) allowing the programmer to express his requirements to the computer. The programmer writes his programs in a 'high level language' which is then processed by a compoler, or he can skip this step and write them straight into 'assembly language' — which no longer resembles English but is a mixture of two- or three-letter mnemonics and numbers specifying address locations in the computer's memory.

BASIC became popular about 10 years ago and it remains popular as a first language for hobbyists. Pascal first came on the scene in 1975 but really took off with the advent of UCSD Pascal in 1978. In the last six months COMAL has become the most talked about language. It's a development of BASIC which includes features derived from Pascal (ALGOL actually, Ed), but although it stimulates a lot of interest, there are, as yet, no books available about it and few people around can actually program using it.

There are literally hundreds of books on BASIC. All the popular micros start out running BASIC and, to my knowledge, all of them come with at least a manual defining their dialect of the language. In some cases the information provided is insufficient for the beginner to start from, as is the case when the machine comes with the CP/M Microsoft BASIC Manual, which is merely a list of commands available. In others, the level of instruction is excellent and the beginner need look no further — a case in point is The Applesoft Tutorial, which is a model that we would like to see others copying.

When choosing a book about a programming language you have to decide whether you want a book that is going to restrict itself to teaching you how to program in a given language or one that is also going to teach you some of the principles of programming. The first book we have chosen falls into the former category. **Making BASIC Work for You**, by Claude J DeRossi, is written in an 'informal, non-technical style' and appears to succeed as an easy-to-read, teach-yourself guide not restricted to any particular machine. One disadvantage as far as the complete newcomer with a personal computer is concerned is that this book is oriented to a time share system so that it describes the wrong environment. An advantage is that it is a relatively inexpensive book, but take heed of this before you go out to buy it: the same author and publisher have brought out the same text under another title — **Learning BASIC Fast** — and the revised edition of this book sells for over twice the price!

A book that falls into the other category is **Introduction to Microcomputer Programming** by Peter Sanderson. This is intended as a simple introduction for users of micros whether commercially oriented, teachers or hobbyists. It starts with a general introduction, followed by a chapter on flowcharting, and then one entitled 'Choosing a language' which covers a number of high level languages very briefly and with some factual inaccuracies. The next five chapters are devoted to BASIC and the book rounds off with two chapters on assembly and one on program development and testing, which is far too short to be useful. This book does, however, include some useful examples and exercises in its middle section.

Richard E Mayer's **Ten Statement Spiral BASIC : From Calculator to Computer** also falls into the latter category. This is a book written for absolute beginners in programming who, in the author's own words, want to 'learn how to communicate with computers'. Its purpose is to give an understanding of how computers work rather than to give a complete working knowledge of BASIC. The author attempts to do this by restricting his account to only a part of BASIC, the 10 statements of the title, namely : READ, DATA, LET, PRINT, IF, GOTO, END, FOR, NEXT and INPUT. These are used in programs which handle a variety of simple arithmetical problems to demonstrate how computers can be used to carry out such tasks. The idea of the 'spiral approach' is that only a limited amount of information is presented initially and more peripheral details are added only after this central core has been understood. The book has two weaknesses. First, its approach is deliberately repetitious, this can be frustrating to those who grasp the author's point first time round. Secondly, it employs a model of the computer system with punched cards (!) which could lead the novice reader to adopt a false impression. We were not very impressed by this book. It seemed boring and pedantic compared to many of the other introductions to BASIC which are available. However, for people who find computing completely bewildering and a little terrifying, or where access to computers is extremely limited, its gradual and repetitive approach may be found useful.

Two books by Dwyer and Critchfield address themselves to the beginner who has a new micro to explore. **You Just Bought A Personal What?** is a general introduction which features Level II BASIC (on Tandy only) and Microsoft BASIC (on most other popular micros but with variations), while **A Bit Of BASIC** provides an eight-hour self-study course that goes on to rather more advanced features which include some graphics. Although from different publishing houses, these two books share a distinctly American format. Both are large softbacks, enlivened with entertaining cartoon illustrations. We thought the latter book represented value for money compared with many others.

For a new British book about BASIC on micros look out for the latest title from Babani, **An Introduction to BASIC Programming Techniques,** by S Daly. This slim volume throws the reader in at the deep end — by page four you are solving quadratic equations, so if you are not well up on maths you may feel a little lost. However, if you can keep up with its fairly rapid pace you'll find that this little book covers the same ground as many that appear as giants beside it. Chapter 7 presents six complete programs including one to work out biorhythms, one to compute standard deviations and another to generate tuneful musical note sequences. In our opinion, this book is worth its price for these programs alone.

The titles included in this month's selection were:

Making BASIC Work For You, by Claude J DeRossi, published by Reston (Prentice Hall) (1981), 179 pages, £3.85.

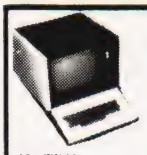
Introduction to Microcomputer Programming, by Peter C Sanderson, published by Newnes Technical Books (1980), 138 pages, £4.25.

Ten Statement Spiral BASIC : From Calculator to Computer, by Richard E Mayer, published by Glencoe (1980), £5.65.

You Just Bought A Personal What? by Dwyer and Critchfield, published by Byte Books (McGraw Hill) (1981), £8.50.

A Bit Of BASIC, by Dwyer and Critchfield, publshed by Addison Wesley (1980), 184 pages, £3.85.

An Introduction to BASIC Programming Techniques, by S Daly, published by Bernard Babani (1981), 87 pages, £1.95.



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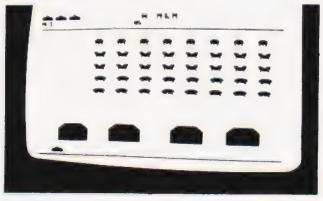

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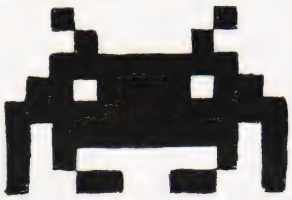

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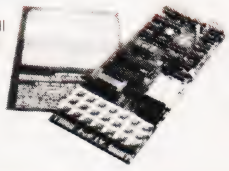

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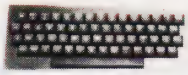

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Dear Sir,

It has been said that "The bad wheel usually creaks the most" so before I start to "creak" let me commence by complimenting you on the standard of your magazine, however. . .

Shut your eyes, put your feet up on your desk, let your mind wander maybe 6000 miles or more southwards to a modest home in 'darkest' Africa. The latest issue of Computing Today has hit the news stands. Gathered around the PET, better known as Fred in this household, stand three young boys aged from 9 to 12 years. The eldest has the magazine in one hand whilst the other hand is flying across the keyboard, greedily feeding in the latest program. Alas! At run-time the blasted machine throws out error messages that, if translated, would make a sailor blush. Advance the clock a few hours. Father comes home from a day at the salt mines and instead of being able to relax with the evening news, is hauled feet first, kicking and screaming, to this machine, designed and built by some obscure womans' libber to reduce the male chauvinistic pigs amongst us to neurotic cretins. Those at least are the feelings of the writer at a time long past midnight, having at last been able to make a redesigned bomber drop its load on the unsuspecting fish in the dam below.

On a more serious note, would it not be possible to request authors to elaborate their software with remarks to detail various key sectors and the purpose of variables so that in the event of a printer's error, the original algorithm can be recreated and the error easily corrected?

Secondly, can you possibly supply me with the name of the manufacturer of the Video Genie Computer (not the UK distributors) in Hong Kong?

Thanking you,
Yours faithfully,
Alan Nathan.
Cape Town,
Republic of South Africa

(*The Video Genie is produced in Hong Kong by Eaca Computer Ltd., who according to the latest issue of the 'Hong Kong Trader' are set to launch a second Genie onto the market later in the year. Their address is Ground Floor, Arise Industrial Building, 20 Hung To Road, Kwun Tong, Kowloon, Hong Kong. Ed.*)

Dear Sir,

Having read both the ATOM review (April 81) and Mr Meredith's reply in the June issue, I feel that an important point is being missed concerning the BASIC supplied.

BASIC is nearly 20 years old and has been criticised for never having had a standard produced. The version of BASIC in the ATOM seems sufficently distant from any known BASICs to warrant a name other than BASIC. In view of the BASIC being developed for the BBC will there be much support for the ATOM in its present form? Or will it turn into another MK14?

On the point of jumping out of FOR-NEXT loops, many interpreters can get into trouble if the return address is left on the stack.

A possible method to exit early from such a loop is

```
100  FOR X=1 TO 100
200  IF A(X)=0 THEN X=100 : GOTO 900
300  :
900  NEXT X
```

Finally, text can be stored exactly as typed in, if preceded by a REM statement. Microsoft BASIC will not tokenise this.

Yours faithfully,
David Bolton B.Sc.
Carrickfergus, Co. Antrim

(*Acorn will be introducing a BBC BASIC ROM for the ATOM. Ed*)

Dear Sirs,

Four of us have put together a small micro group which is centred around the area of Wantage, Abingdon, Didcot, Wallingford and Newbury. We refer to ourselves as the South Oxford Computer Club and would like to know if you will help to publicise the group. We meet in East Ilsley on the first Tuesday of each month. The group consists of 6800, Z80 and 8080 users. There are four phone numbers where we may be contacted. They are Mike 0235-834402, Malcolm 0235-816949, Paul 0235-815305, and Rocky 0635-34456.

Thanks for your help,
A L Jardes, III
Newbury, Berks

Dear Sir,

Thanks must go to A P Stephenson for his excellent program 'Multicolumn Records'. May I point out an error which must have crept in during transcription to your magazine. Line 2465 should not be there! 'GOSUB 2360:GOTO 210' is to be included in line 2460. Also line 2270 should read IF K$=" [SPC]" THEN R=R−1:GOTO 580.

May I add that those who have PET BASIC 4 will need to change line 185 to read 'POKE 144,88' and line 3490 to read 'POKE 144,85:END'.

Yours faithfully,
G J Tucker
Paignton, Devon

Dear Sir,

I am a TRS-80 owner and I would like to find another TRS owner in Brussels. If there is anyone out there. . . I have only just started out in computing and would like to share ideas (and mysteries!) Also I agree with Peter Tootill (CT July '81), there are no cassette or keybounce problems with the more recent Model I's.

Yours faithfully,
Timothy Noyce,
Brussels, Belgium

Dear Sir,

With reference to B Wragg's letter in the July issue. The original listing of 'Space Invasion' does result in the game ending with a score of about 26,000. If Mr Wragg has the necessary stamina he may attain scores of 220,000 plus by making the following changes.

Change memory location

```
0AB4   TO 20 F5 0B
0AB7   TO EA
```

Then add the following

```
0BF5  A5  4A  LDA
0BF7  C9  20  CMP
0BF9  90  04  BCC
0BFB  C6  4A  DEC
0BFD  C6  4A  DEC
0BFF  60      RTS
```

As you can see I've managed to keep within the 2K — just. The higher the value in 0BF8 the easier the game.

Yours sincerely,
J G Hawthorn
Watford, Herts

Dear Sir,

I would like to bring to your readers' attention the setting up of the Apple Music Synthesis Group. The lion's share of micro-based digital synthesis is being captured by the Apple II, but, so far, no attempt has been made to co-ordinate activities or direct them to particular musical goals.

The AMSG is interested in hearing from any Apple-owning musicians, but, in particular, will be concerned with the Alf, Mountain Hardware Music System, alpha-Syntauri system, and the Soundchaser. Long term goals include an international conference in London and the release of LPs of Apple music but, initially, feed-back is urgently requested. A newsletter is envisaged but, for the time being, user contact will be via a regular feature in the new Apple magazine, Windfall.

Further information on the AMSG, is available from me at the address below, but please enclose a SAE!

Yours sincerely,
Dr David Ellis,
22, Lennox Gardens,
London SW1

Dear Sir,

I would be most grateful if you publish a user group column in your magazine to include this entry.

A new local CBM/PET/VIC user group covering the North Herts Area has been formed. It holds regular meetings, talks, exchange of news, views etc. The club is affiliated to IPUG. Anyone interested should telephone Hitchin (0462) 54435 or write to the address below.

Thanking you for your assistance.
Yours faithfully,
N Mortiboy
2, Spurris Close,
Hitchin,
Herts SL4 9QE

Dear Ed,

After keying in A P Stephenson's Multipurpose, Multicolumn Records program in the July 81 issue, I found a potential bug and give below my solution which I hope you will pass on to others.

The BASIC I use is Sharp (MZ80K) and is so close to the PET Microsoft BASIC that my code should work immediately on the PETs it was originally designed for.

Record Search

A P Stephenson does not allow for more than one entry with the same data in the KEY column. This code corrects that and also allows for incomplete entry of the KEY field (ie MIN will find MINATAUR, MINEFIELD etc — in fact any word containing the sequence "MIN"). Also, once found, the program will ask if the found data is that which is required, if not the search will continue from where left off.

```
515  FOR XX = 0 TO LEN (A$(R,1))
520  IF I8$ = MID$(A$(R,1),XX,LEN(I8$))
     THEN 565
525  NEXT XX
565  PRINT A$(R,1);"?";:INPUT A8$:IF A8$
     = "N" THEN 530
```

Column Search

As for Record Search, the Column Search routine is modified to allow for "incomplete" entries.

```
2200  FOR R = 1 TO Y
2210  FOR XX = 0 TO LEN(A$(R,C))
2212  IF MID$(A$(R,C),XX,LEN(DI$)) = DI$
      THEN PRINT TAB(10); A$(R,1);
      TAB(22);"Rec";R
2215  NEXT XX
2217  S = 1
```

I know that this does mean more code (the person who puts the program into an 8K machine has a sense of humour) and that it slows the search down, but, and this is the important part, it is "user friendly". In fact I was quite astonished to notice the lack of similar code in the original, which I am delighted with.

Oh well, now I suppose APS will be on the lookout for one of my gems — well, if I can get the hang of the MZ80 keyboard (I am a trained typist) and can get some time off from the wife, I'll see what I can do.

D A Thompson
Chatham, Kent

Dear Editor,

As a beginner (and probably the only ZX80 user in Port Elizabeth) I am very confused as to whether or not moving graphics are feasible on the ZX80. All reviews say "impossible", but the numerous adverts in CT say "yes". This contradiction has put me off buying any programs.

If you could, through "Printout", enlighten me (and presumably others) I should be most grateful.

I have had hours of enjoyment (albeit painful at times) from both the MK14 and ZX80. Looking forward to CT (one month late) on the 1st Friday in the month.

Keep up the good work.
Kind regards,
R R Diamond
Port Elizabeth, South Africa

(*This is a common question and the answer, although generally well known, is worth repeating. The ZX80 and ZX81 computers use a serial print file which is filled and then displayed. The ZX81 contains a routine which allows you to put information into specific locations in that file before it is displayed, thus giving the illusion of moving graphics. The ZX80 did not have this facility built in but the software routines are commercially available. It should be noted that this is NOT the same as providing a memory mapped screen and the system is not as flexible. Ed.*)

Dear Sir,

I feel that the program 'Holocaust' by Mr S Goodwin in the July issue should not have been published. Nuclear war cannot in any way be considered something to make a game of.

Just because the microcomputer makes it possible to play games such as this in a relatively exciting and interactive way, this should not be regarded as a licence to produce games as tasteless and unpleasant as Holocaust.

Nuclear war must never be made to appear acceptable. The survival of us all, including Mr Goodwin, depends on its total unacceptability.

Games of this type in which one can 'fight it out in your living room', only make light of the threat of nuclear war and the disastrous consequences should one occur.

Hoping that in future you will choose your games programs for publication with more thought.

Yours sincerely
C M Jordan
Powys

(*It would appear from the overwhelming number of letters and telephone calls from CT readers looking for the missing section of Holocaust that the majority do not share your views. In my view I feel that the only way people are ever likely to do anything about the 'threat of nuclear war' is if they actually realise the kind of destruction that is likely to result. Unfortunately the BBC decided to 'ban' the programme 'War Game' which certainly brought home the realities. I trust you have complained equally to the other publications who have run similar programs and to the makers of Space Invader type machines for promoting the wanton killing of cute little green bug-eyed monsters. Ed.*)

Dear Sir,

Mr Want's letter in your July edition is correct — the PET does run noticeably slower on Integer arithmetic. Individual variables seem to take the same space as floating point numbers as well, but arrays only need two bytes per integer, as compared with 5 for floating point numbers.

The storage space for integer data is therefore 150% greater than for ordinary numbers, in array systems. This is about the only advantage, although there would be some advantage in the handling of Boolean expressions as well.

Jim McCartney
Coleraine,
Co. Londonderry

Dear Sir,

Someone appears to have misled Mr Want on this matter (July issue). I have not seen claims for increased speed by using integer variables on the PET, though they are made for other machines.

I refer Mr Want to the PET Guide by Donahue and Enger, Page 57: "PET BASIC converts any integers to floating point representation. . . an integer array (my emphasis) uses less storage space in memory (two bytes for an integer versus five bytes for a floating point number)"; and page 322: ". . . for integers the unused three bytes are dropped for array elements."

The following simple test took 97 jiffies on my own machine, whether the arrays were X( ), Y( ) or X%( ), Y%( ). However the storage requirement for the floating point version was 5130 bytes against 2129 for the integer version.

```
100  T = TI
110  DIM X(500),Y(500)
120  FOR K = 1 TO 500
130  X(K) = K + 1
140  Y(K) = X(K)*3
150  NEXT K
160  PRINT TI - T
```

Yours faithfully,
B Thorpe
Cheadle, Cheshire

Dear Sir,

I would like to see a computer club start up in the area of Chippenham and Calne. To aid in its beginning I am prepared to liaise with people who feel they are interested in helping to start it up and run it, and those who just want to come along. I aim to make it into a multi-machine, multi-language (varieties of high and low level languages) multi-processor club to cover everything and with two aims.

1. To spread ideas from machine to machine, language to language, etc.

2. To enable newcomers to learn and choose a computer for themselves.

People in the area (or outside) should, if interested, write to me at Pinhills, Bowood, Calne SN11 0LY, giving details of their machine, interests and what they can do to help and what day they would like it on, enclosing an SAE.

Thank you,
Matthew Jones

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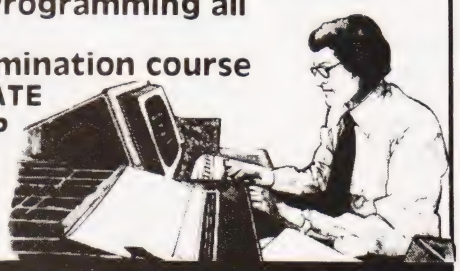

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PROGRAMMING LANGUAGES

Dr G J Marshall

If you can't afford the actual hardware of a robot you can still use your micro to simulate their behaviour with WSFN

WSFN is a robot control language. It is intended to be a language in which commands to a microprocessor-controlled robot can be expressed, and then issued using a keyboard as the input device. The language was devised by Lichen Wang and was first published in 1977. Wang also invented the name of the language, which stands for something rather silly that can be found by consulting the references given at the end of this article. The language possesses a small number of instructions. All robot commands must be expressed in terms of this small repertoire, which includes instructions such as 'move forward one step' and 'turn to the right'. However, the language permits these instructions to be combined in quite complex ways, so that sophisticated programs can be written despite the smallness of the language. A version of the language is available for controlling a simple robot, such as a 'Turtle', making it interesting to anyone seeking a new application for their micro. Other versions are written to control a cursor which can leave a trace on a screen to show the path it has taken. This provides either a robot simulation or a facility for drawing patterns depending on how you regard it.

Language Properties

As a robot command language, WSFN provides the robot with a memory and generates the signals necessary for the robot to obey the commands issued to it. The memory consists of an accumulator and a facility for storing macros. The accumulator is an eight-bit register capable of storing any integer from 0 to 255. A macro is a sequence of commands that is given a name. When a macro is defined, the sequence of instructions is stored together with the name. Subsequently, the name can be given as an instruction, and when this occurs the name is replaced by the associated sequence of instructions which are then executed. Thus, a macro is a way of extending the language.

The commands to the accumulator are '+' to increment it and '−' to decrement it. Repetition is achieved by preceding the command with the number giving the repetitions required. Thus, 32+ means increment the accumulator 32 times. Preceding an instruction by 'A' indicates that it should be repeated as many times as the number in the accumulator. To illustrate this, A+ is an instruction to double the number in the accumulator, while A− is an instruction to set the accumulator to zero.

Since setting the accumulator to zero is a useful facility, it may be worth defining it as a macro. This is done by giving it a simple letter name that does not clash with the name of any other instruction, say Z, and then issuing the command:

```
Z = A-
```

This stores the macro definition A− with the name Z, and, subsequently, when the command 'Z' is issued, the accumulator becomes zero.

In WSFN, brackets can be used to group commands, and blanks are significant, being interpreted as 'no operation' instructions or instructions to do nothing.

The remaining instructions can conveniently be explained in terms of a system controlling a cursor that is leaving a white trace on a black screen. There are three initialisation instructions, 'C' to clear the screen, 'N' to face North, or up the screen, and 'H' to send the cursor home to the centre of the screen. These instructions are for convenience when using a screen, and have no particular relevance to controlling an actual robot. The fundamental instructions for robot movement are 'F' to move one step forward and 'R' to turn 45° to the right (ie clockwise as seen from above). These two instructions are sufficient to move the robot to any position within its field of activity.

Additionally, there are conditional commands signified by 'T' and 'S'. The instruction Txy, where x and y represent commands, means *if* A #0 then execute x *else* execute y. Similarly, Sxy means *if* the sensor indicated an obstacle execute x, *otherwise* execute y. With this very small instruction repertoire, programs for quite sophisticated tasks can be written.

Example Programs

It is always possible to describe to a robot the way in which it should follow a particular path by providing the directions in detail. A program that causes a robot to move along a square path and return to its starting position is:

```
4(2R8F)
```

A square of the same size (but in a different position) is traversed anticlockwise rather than clockwise by:

```
4(6R8F)
```

A robot faced with an unknown labyrinth, such as that in Fig. 1, can find the way through it by use of the conditional instruction which tests the sensor. Assuming that the labyrinth has only right-angle turns, an algorithm for proceeding through it is:

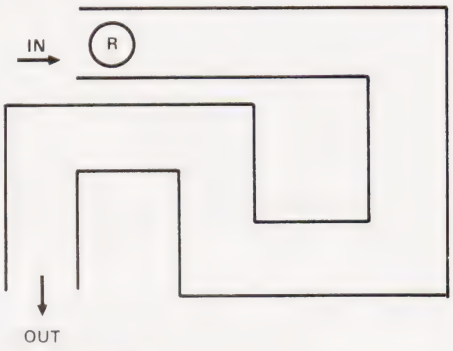

Fig.1. Labyrinth.

```
Repeatedly
  if you can, go ahead
    else
      (if you can, turn right
        else
          turn left)
```

In WSFN, this algorithm is expressed as repeated executions of

```
S(2RS(4RF)F)F
```

Similar programs can be written to enable a robot to find its way through a maze. A maze is more complex than a labyrinth, since it can also contain T-junctions, crossroads and dead ends. However, a program for exploring a maze need be only slightly more complex than that for a labyrinth. For this reason, WSFN may well be of interest to Micromouse enthusiasts.

Recursion is supported in WSFN, as illustrated by the following, in which the macro U is defined in term of itself:

```
U = T(AF2R - U)b
```

where b denotes a blank, meaning that the macro U requires that nothing should

be done if A=0. You might like to find the result of executing the program:

```
Z9+U
```

The 'Dragon curve' illustrated in Fig.2 was produced by:

```
L = T(-L6RJ+)G
J = T(-L2RJ+)G
G = 4F
Z8+L
```

Implementations

Wang published WSFN in Dr Dobbs' Journal, Number 18,1977, in an article entitled 'An interactive programming language for control of robots'. The article includes a listing of an implementation of the language written in 8080 assembly code. Routines are given for controlling a 'Turtle' and for screen cursor control. Actually, it is necessary to look at Dr Dobbs' Journal, Number 20, as well, because the article had to be reprinted after being badly mangled.

A version of WSFN for the PET is available from Petsoft. It is written in BASIC and enables control of a cursor on a 39 x 78 grid. It comes with documentation which, although useful, is not entirely adequate. Figure 2 is a photograph of a pattern on a PET screen generated with this version of WSFN.

Conclusion

WSFN is a small language for an interesting application. It includes the features that are necessary to construct all the useful program 'shapes'. Consequently, it reveals the small core that is really essential to any computer language. Programs written in WSFN are concise but, as a result, they can be hard to read. These factors must be balanced against each other in any language, although languages do exist with which it is hard to make programs either concise or readable!

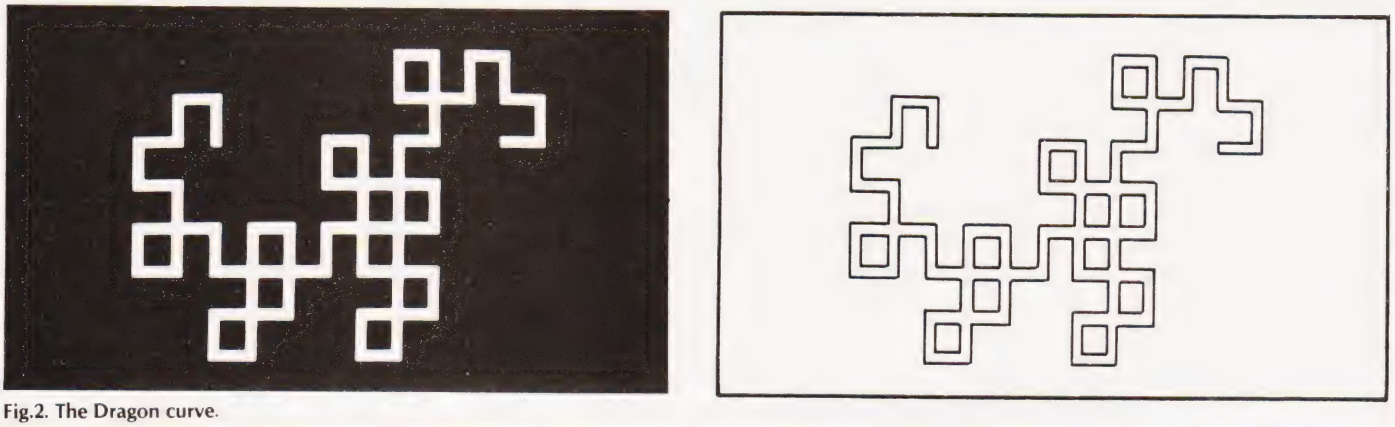

Fig.2. The Dragon curve.

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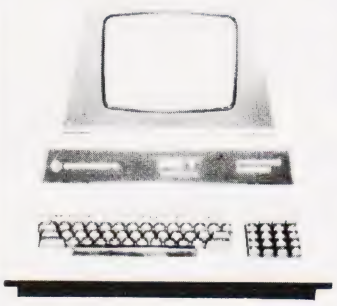

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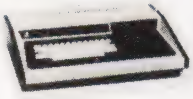

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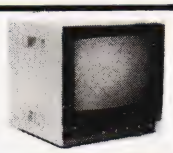

VIC 20

Colours
24 total. 8 for characters, 8 for border, 16 for screen mixed as you wish. Basic colours on program keys are black, white, red, blue, light blue, green, yellow and purple.

Sound
3 Tone Generator for music, "White Noise" Generator for language and sound effects. Each Generator gives 3 octaves. Reproduction is through TV speaker.

Character/Line Display
22 Characters by 23 lines, 64 ASCII characters, pet-type graphic character set.

Keyboard
DIN typewriter keyboard with 8 programmable function possibilities via 4 special function keys. Colours are directly addressable from the keyboard.

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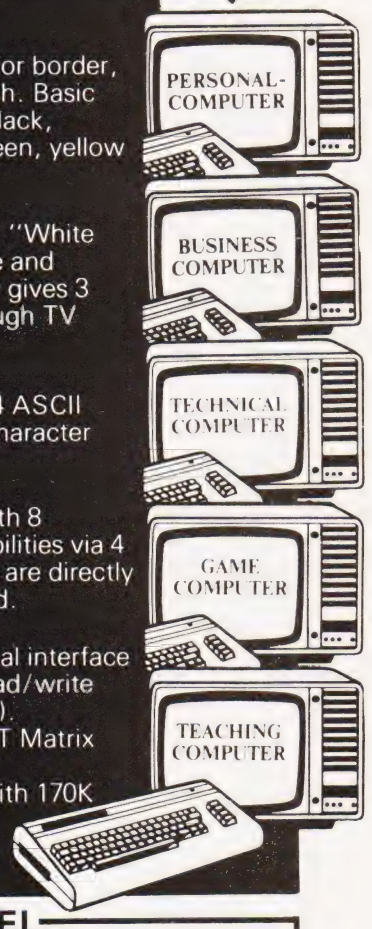

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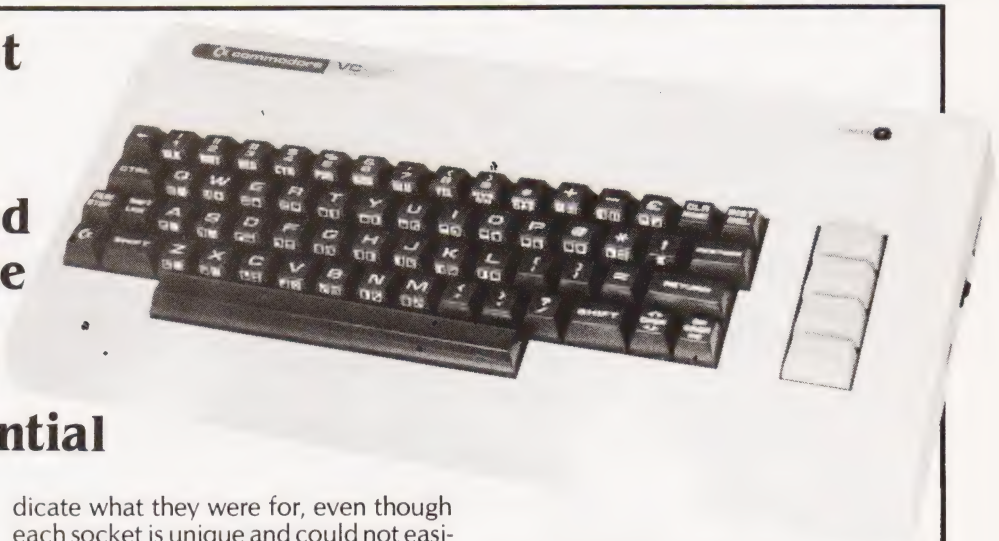
UNVEILING THE VIC

Peter Freebrey

The VIC is the latest offering from Commodore and appears to be aimed directly at the home computer market. We take the lid off and assess its potential



The long awaited VIC-20 is about to hit this country and Commodore confidently predict high sales of this remarkable little machine. Initially to be sold through computer shops and existing dealers, it is understood that within a few months the VIC will be available through outlets in most major high streets throughout the land.

Who will buy it? What will they use it for? Will the VIC-20 be bought as a microcomputer, a sophisticated home entertainment centre or as an educational tool? It could fulfill the functions of all these and many more. VIC's future should be full of interesting developments.

Physical Appearance

As you open the box, the VIC-20 gives the appearance of a relatively small neat package. It will sit quite comfortably on desk or table top with enough space behind it to stand one of the readily available portable colour televisions. The case is made of white plastic, is robust and well finished with non-slip feet that are really effective (an important point with light machines — there's nothing worse than the unit skating across the table as you start typing!). The full-size keyboard is somewhat similar in layout to the SuperPET but without the numeric keypad; there are four double-sized function keys in its place. Although not perhaps of professional quality, the keyboard has a good feel to it and is easy and positive to use.

Sockets are provided on the right-hand side and rear of the housing, those on the right being a games port (joystick control, light pen, etc) and power supply connection. Also sensibly placed on this side is the ON/OFF switch. At the rear are found: the expansion port (additional RAM or VIC program cartridges); Video and Audio port; Serial port (printer, discs, etc); Cassette port and the USER port (IEEE, modem, etc). The quality of the sockets used is adequate for the task intended but we were disappointed to see no labels or markings of any kind to indicate what they were for, even though each socket is unique and could not easily be used for the wrong purpose.

Internally the VIC shows neat construction, with a well conceived layout that will prove easy to service should the need ever arise. There is adequate ventilation with open vents beneath the unit and shrouded vents on top behind the keyboard. The case is held together with two plastic hooks and three screws.

What Comes Out Of The Box

In addition to the basic unit there is also a separate power supply, an RF modulator and video cable together with a 164-page manual. The power supply did not get noticeably hot after working for many hours, nor did the complete system exhibit any indication that the voltage or current were not as they should be.

The RF modulator supplied with the review model was not enclosed or boxed in any way, presumably being a pre-production unit. Hopefully those reaching the shops will be the finished article. The manual was eagerly scrutinised, as we had been promised an improvement over previous Commodore offerings. 'Personal Computing on the VIC-20, a friendly computer guide' is certainly several magnitudes better than the original PET manuals but still falls far short of what should be presented with a machine that has the potential of the VIC. It is essentially an 'idiot's guide' to the computer, trying to give a rapid 'hands on' crash course on operating the VIC. It does not really succeed as a teaching manual and one cannot escape the impression that with instructions such as these the VIC is presented as a noise producing, colour changing, 20th century toy. This, of course, is far from the truth as the VIC is capable of being very much more. The manual errs drastically in assuming that British televisions are similar to those in America, working with VHF (ours use UHF!) and also that our antenna (aerial) connections consist of two screw terminals (most unlikely). In use, the manual will certainly help the absolute novice in quickly getting his VIC to do something interesting but it is going to be very frustrating to those who, although new to computing, are of reasonable intelligence. They may want their computer to do something other than draw birds flapping their wings and making chirping noises.

What, for example, are those four important looking keys on the right of the keyboard? The manual tells us they are 'Programmable Function Keys and can be assigned tasks or functions from within the applications that you create . . .'. Well, speak to me someone . . . how do I use them? The manual remains mute! Are there other uses for a FOR . . . TO . . . NEXT loop other than as a time delay! Reading our friendly computer guide leads us to believe that it would appear not, although one program hints that there may be more to this statement than meets the eye! The appendices do have a fair amount of useful information: memory maps, POKE charts and error messages, to name but a few. At least Commodore get a merit point for trying — their manuals are improving, if a little slowly.

The VIC Powered Up

On connecting the VIC to its power supply, the RF modulator, a television set and switching on we are informed that we are about to use V-2 BASIC and have 3584 bytes of memory free. The keyboard, although similar to SuperPET, differs in two significant ways: it has no numeric keypad and it has two different SHIFT keys and a colour control key. It will generate the same wide range of predefined graphic symbols as the PET but now the keys call up two sets of graphic characters depending on which shift key is depressed. There is also the option of one graphic set together with upper and lower case text. For some reason Commodore have decided to

label one SHIFT key with their own logo . . . good flag waving, but not so clear as SHIFT 2.

Initially the most noticeable feature (other than the colour) is the format of the screen, which is 22 x 23 characters and takes some getting used to after the PET's 40 x 25. You may write program lines of 88 characters (PET allows 80): this could mean four lines of 22 characters on the screen for just *one* program line! This is not so easy to understand as it is on the PET but it does not take too long to adapt, albeit the number of program lines on display at any one time will be less and could be as little as five complete lines.

The VIC cassette interface is compatible with the PET cassette and VIC BASIC uses the same BASIC commands as PET BASIC 2 plus the additional colour commands required by the VIC. We are told that PET programs are compatible with the VIC. VIC *will* load a program from cassette written for a PET but could need some attention before it will RUN in a satisfactory manner.

The major areas of difference are:

a) the screen is memory mapped but uses different POKE addresses.

b) a program written for PET and using text will be formatted for a 40 character line.

c) larger quantities of text will be organised to use PET's 25 lines without scrolling.

VIC will RUN the program providing the POKE addresses are altered but the text may be difficult or impossible to read. A frustrating situation, but easy to overcome with a little patience.

The memory mapped screen has two POKE addresses for each character cell, one (between 7680 and 8185) is used to define the position and the character or symbol required and the other (between 38400 and 38905) specifies the colour of that character. VIC has a very versatile control over the colour representation displayed on the screen. It offers any combination of eight border colours (the area outside the 22 x 23 display area) and eight character colours. The first two are defined by one POKE code. The others are defined by use of the CTRL key and the appropriate colour key within a PRINT statement. To get a light orange border, a purple background and black text all that is needed is:

1) POKE 36879,156

2) PRINT . . . open quotes . . . press CTRL and BLACK (numeral 1) . . . your text . . . close quotes

There is no need to specify black text in any following PRINT statements, as it will remain black until a change is specified. The alternative to 2) above is to POKE the character required of the colour required direct to the screen, so building up a coloured display on the chosen background/border colour combination.

Making Music?

Not only, but also . . . the VIC has three music 'voices' listed in the manual as alto, tenor and soprano together with one noise generator for 'special' sound effects. Any one 'voice' will cover three octaves, and the total available range using the different 'voices' works out to be about seven octaves. Five of them will give a reasonably pleasant sound and two could well get the reaction of 'Ye gods . . . what was that'! Individual tones are obtained by POKEing a value (between 135 and 241) to the appropriate 'voice' address. Volume on a scale from 1 to 15 is determined by an additional POKE. A number of sample programs for sound generation are given in the manual from 'turn your VIC into a piano'(!) to such special effects as Red Alert, Birds Chirping and Ocean Waves. The range of possibilities seems only limited by your patience and ingenuity.

VIC uses the upgraded 6502A microprocessor chip which is faster than the PET's 6502. There is no machine language monitor, which means that to use machine code you will have to:

a) create a machine code program on a PET, save it onto tape and load this program into the VIC;

b) wait until Commodore launch a machine code ROM cartridge;

c) wait a little longer for a cassette loaded program, although if the program you write crashes, you will have to switch off and start again; or

d) write machine code programs via BASIC PEEK and POKE statements . . . which should keep you busy until option b) arrives!

Goodies To Come

Appendix A of the manual is entitled 'VIC Accessories, a quick introduction'. To our knowledge the only accessory available initially is the PET cassette recorder. The printer is not far behind and doubtless the others will arrive in due course. Briefly they are:

- dot matrix printer
- super expander cartridge . . . 3K add on memory, high resolution graphics
- programming aid cartridge . . . programmer's toolkit, machine language monitor
- master control panel . . . accepts multiple cartridges/memory expander
- VIC single floppy disc drive
- IEEE 488 interface cartridge

Also hinted at elsewhere are the following:

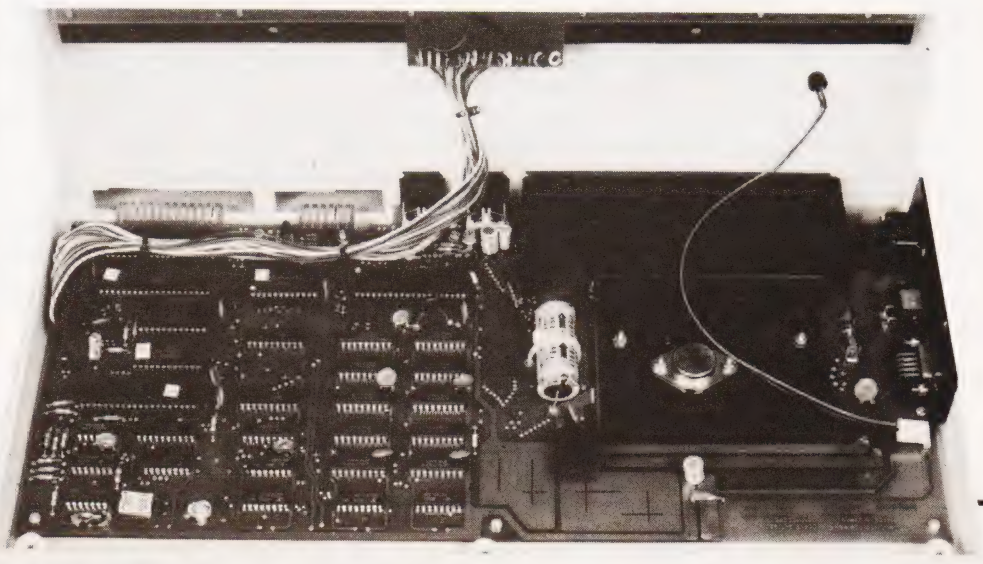
- 8K and 16K memory cartridges
- RS 232 C interface cartridge
- joysticks, light-pens, paddles
- acoustic modem
- various plug-in program cartridges.

Conclusions

Powered up, the VIC performed well, although the television display was somewhat critical to tuning and the block colours of the border and background could have been a little more stable. There was also some occasional colour fringing associated with displayed characters. In fairness, one must remember that the RF modulator of the review model was not in the finished state that production models will have supplied.

The manual leaves a lot to be desired for the person past the initial novice stage and as the VIC is definitely 'user friendly' this stage should be reached quite quickly. There is mention of a 'VIC Programmer's Reference Guide', which may very well fill in the gaps but as it was not supplied we are unable to pass comment. There is no doubt that VIC's versatility with colour displays adds another dimension to any use of the screen, even very simple games become

Internal layout is neat and well thought out.



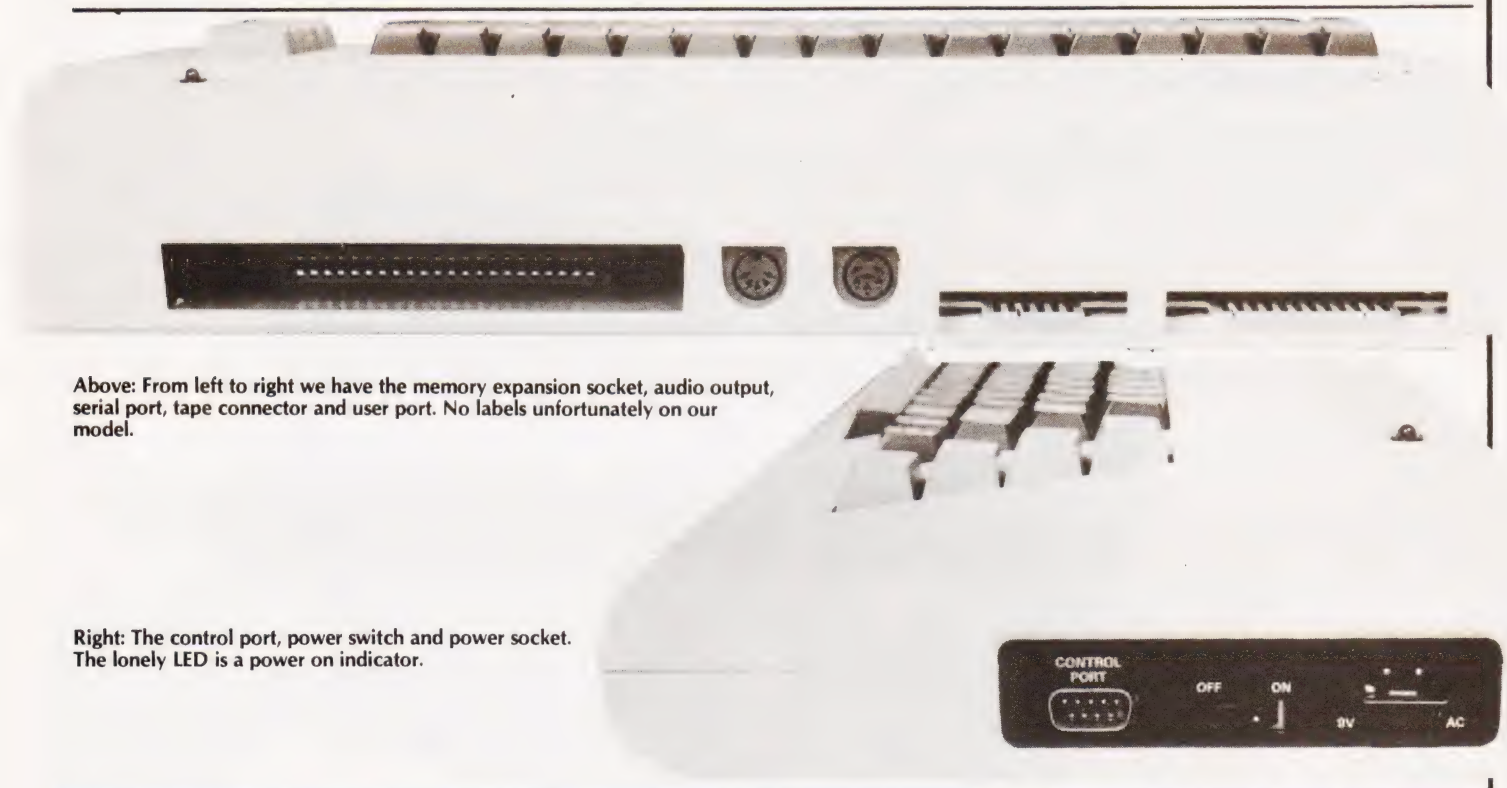
more enjoyable, not to mention graphic displays such as histograms, etc.

The basic VIC has a little over 3K of user memory — fine for the novice, but as he progresses this will soon need to be increased. The big question here is how much will additional memory cost? As yet, we have no firm answer.

The machine appears to be aimed fairly and squarely at the home environment, although we have doubts that Commodore's suggestions that it will be used as a diary or for home accounts will really have many followers. The format of the display 22 x 23 characters has yet to be justified — fine for many games and as a demonstration tool, the characters are large enough to be seen clearly at a reasonable viewing distance. Whether it has a future in education only time will tell: with Government grants and subsidies on certain machines together with the advent of the BBC machine, this could be a tough market.

As a computer for the small business the format is against it. By the time one has added the necessary extras (additional RAM, disc drives, etc) it is not an attractive package compared with many other small systems. Unless, of course, one wants to play Space Invaders in colour during the lunch break!

Although the above criticises certain aspects of the VIC-20, one must not lose sight of the fact that the VIC in some ways offers more facilities than the PET and is a fully fledged microcomputer in its own right. Also, the basic unit, with colour and sound, costs less than £200 — which may well be a strong argument in its favour.



Above: From left to right we have the memory expansion socket, audio output, serial port, tape connector and user port. No labels unfortunately on our model.

Right: The control port, power switch and power socket. The lonely LED is a power on indicator.

COMMANDS

CONT	Continues STOPped or ENDed program
LIST	Lists specified line(s) of program to screen
LOAD	Loads program stored on cassette tape
NEW	Erases entire program and variables from memory
RUN	Executes current progam
SAVE	Writes current program to cassette tape or disc
VERIFY	Checks program stored on tape or disc against one in memory

STATEMENTS

CLOSE	Completes and closes any files used by OPEN statements
CLR	Erases all variables in memory leaving program intact
CMD	Sends outputs normally sent to screen, to another device
DATA	List of items to be used by READ statement
DEF FN	Defines complex calculation as a function with a short name
DIM	Defines dimensions of an array
END	Stops a program that is RUNning
FOR	Used in conjunction with TO and NEXT to execute a defined loop
GET	Reads keyboard, result is character of next key pressed
GET#	Used with an OPENed device or file to input one character
GOSUB	Jumps to defined subroutine
GOTO	Jumps to specified program line number
IF	Conditional test,used in conjunction with THEN followed by specified statement
INPUT	Assigns value of keyboard entry to specified variable
INPUT#	As INPUT but takes data from an OPENed device or file
LET	Assigns specified value to specified variable
NEXT	See FOR
ON	Jumps to program line or subroutine as specified by variable
OPEN	Gives access to specified device,printer,disc,screen etc.
POKE	Places assigned value in specified memory location
PRINT	Transmits specified data to screen
PRINT#	Transmits specified data to device or file OPENed
READ	Accesses next item in DATA statement
REM	No effect on program,allows inclusion of text for comments
RESTORE	Resets DATA pointer to the first DATA statement
RETURN	Returns to main program from subroutine
STOP	STOPs a program that is RUNning
SYS	Starts machine language program at specified memory location
WAIT	Halts program until specified memory location corresponds to defined value

NUMERIC FUNCTIONS

ABS(X)	Returns absolute value of X
ATN(X)	Returns the angle,measured in radians,whose tangent is X
COS(X)	Returns cosine of angle X (in radians)
EXP(X)	Returns exponential of X
FNA(X)	Returns the value of the user defined function A (see DEF FN)
INT(X)	Returns integer part of X (rounded down)
LOG(X)	Returns natural log of X
PEEK(X)	Returns contents of memory location X
RND(X)	Returns random number between 0 and 1
SGN(X)	Returns sign of X
SIN(X)	Returns sine of angle X (in radians)
SQR(X)	Returns square root of positive number X
TAN(X)	Returns tangent of angle X (in radians)
USR(X)	Program jumps to machine language program

STRING FUNCTIONS

ASC(X$)	Returns ASCII code of the first character of X$
CHR$(X)	Returns string character whose ASCII code is X
LEFT$(X$,X)	Returns the leftmost X characters of X$
LEN(X$)	Returns the number of characters in X$
MID$(X$,S,X)	Returns X characters starting with the Sth from X$
RIGHT$(X$,X)	Returns rightmost X characters of X$
STR$(X)	Returns string representation of number X
VAL(X$)	Returns numeric value of X$

OTHER FUNCTIONS

FRE(X)	Returns the number of unused bytes available in memory
POS(X)	Returns column number where next PRINT statement will begin
SPC(X)	Forces PRINT statement to skip X spaces forward
TAB(X)	Used in PRINT statement,next item will be printed in column X

NOTE: Most of the above have abbreviated forms, PRINT may be written as ? whilst most others are abbreviated by typing the first one or two letters of the key word followed by the SHIFTed next letter of the word.

The BASIC command set available.

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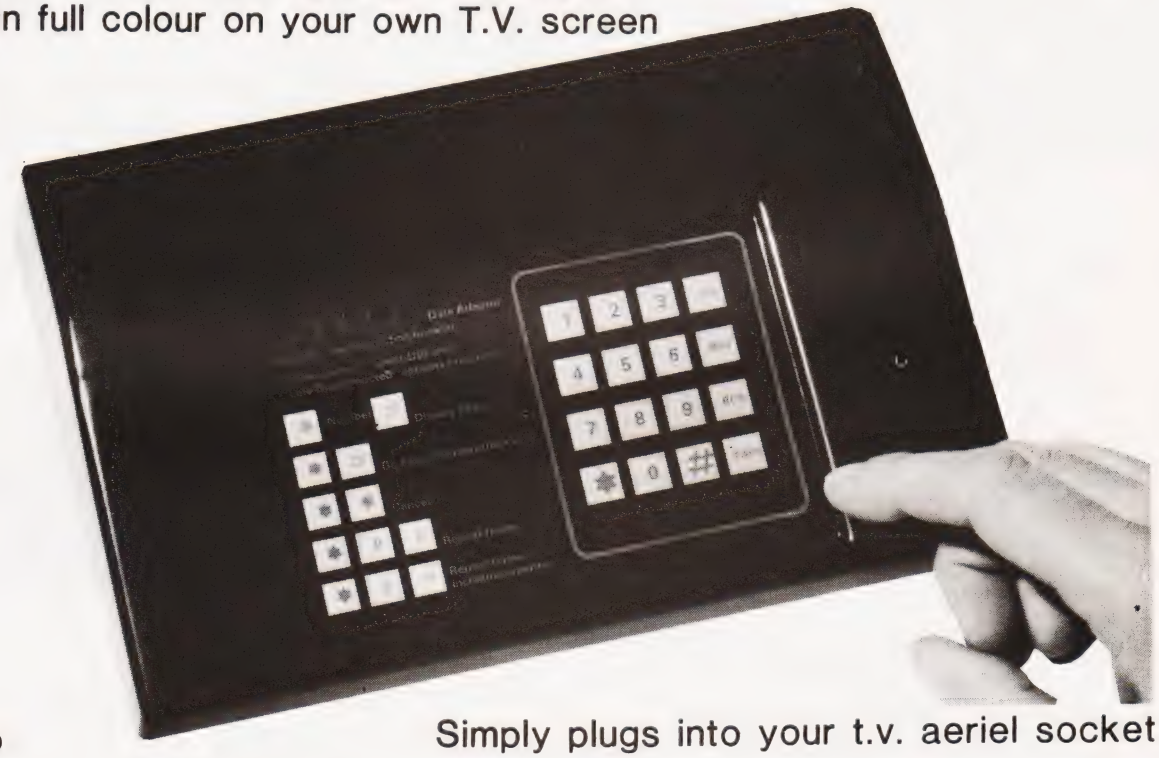

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MICROCOMPUTERS, MICROPROCESSORS, HARDWARE, SOFTWARE AND APPLICATIONS £17.40
Hilburn.

MICROPROCESSOR SYSTEMS DESIGN £18.80
Klingman.

CHEAP VIDEO COOKBOOK
Lancaster. £6.50

SON OF CHEAP VIDEO COOKBOOK £6.65
Lancaster.

50 BASIC EXERCISES £10.05
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MICROPROCESSOR INTERFACING TECHNIQUES £11.20
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BASIC WITH STYLE £4.50
Nagin.P.

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Norman.

HANDS ON BASIC WITH A PET £11.95
Peckham.

THE 8080A BUGBOOK £8.35
Rony P.H.

6800 SOFTWARE GOURMET GUIDE AND COOKBOOK £9.20
Scelbi.

8080 SOFTWARE GOURMET GUIDE AND COOKBOOK £9.20
Scelbi.

6502 SOFTWARE DESIGN
Scanlan. £7.50

1001 THINGS TO DO WITH YOUR PERSONAL COMPUTER £6.00
Sawusch.

6801/68701/6803 MICROCOMPUTER PROGRAMMING AND INTERFACING £10.40
Stangaard.

CP/M PRIMER £8.90

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USING CP/M SELF TEACHING GUIDE £6.85

Z-8000 PROGRAMMING £12.15

GIANT HANDBOOK OF COMPUTER PROJECTS £6.10

57 PRACTICAL PROGRAMS AND GAMES IN BASIC £6.65
Tracton.

PASCAL HANDBOOK £11.55
Tiberghier.

8080/8085 SOFTWARE DESIGN £7.60
Titus.

8085A COOKBOOK £10.50
Titus.

TRS 80 INTERFACING BOOK 1
Titus. £6.75

TRS 80 INTERFACING BOOK 2
Titus. £8.15

YOUR OWN COMPUTER £2.25
Waite.

MICROPROCESSORS. FROM CHIPS TO SYSTEMS £8.50
Zaks.

PROGRAMMING THE 6502
Zaks. £10.50

6502 APPLICATIONS BOOK
Zaks. £10.50

PROGRAMMING THE Z80
Zaks. £11.55

CP/M HANDBOOK £10.90
Zaks.

INTRODUCTION TO MICROCOMPUTER PROGRAMMES £4.90

6502 GAMES £10.50

INTRO TO MICROCOMPUTERS. Vol 0 £8.00

INTRO TO MICROCOMPUTERS. Vol 1 £12.05

PET AND THE IEEE 488 BUS £14.35

8086 BOOK £15.50

WHAT IS A MICROPROCESSOR £10.00

M K Cook B.Sc

MORSE TRAINER

Key in the program to practise your keying

Many people today are still interested in using Morse code, and despite many programs and machines, the human ear is still supreme in decoding a weak, interference-laden signal. The audio filtering between our ears remains the best available by several orders of magnitude. However, as the back of the head is not fitted with an output socket to take advantage of these filters, the decoding also has to be done in the brain. Unfortunately this requires learning and usually involves listening to records, tapes or friends sending Morse code which you can subsequently verify that you have taken down correctly. The trouble with this is that you soon become familiar with the contents of the records and tapes, and unfamiliar with your friends. The answer lies with your friendly computer, which will sit for hours contentedly churning out Morse code for you to learn.

The program is written for a 16K Level II TRS-80 microcomputer or for the disc BASIC. It introduces you to Morse code gradually in a series of lessons. In the first one, the letters are either all dots or all dashes and so easy to learn. As you progress, other letters are added, but you are still tested on those you should already know.

The Class A Radio Amateur Exam requires the sending and receiving of Morse at 12 words per minute, so that is the top speed for which this program is designed. Higher speeds can be achieved by altering the appropriate delay values. Following the recommended practice (see The Morse Code for Radio Amateurs, Mills, M, RSGB Publications), the dots and dashes are sent at 12 wpm rate even at the slower speeds, the spaces being increased to provide a lower overall speed. In this way the code is learned more easily. The program provides a sound output via the cassette output port.

Deft Digits

Each lesson can be one of two types. First, there is keyboard recognition: in this mode the computer gives you a Morse character which you have to match on the keyboard. If you get it right the computer tells you so and one point is added to your score and to your 'tries' total; if you get it wrong you will again be told, just one point being added to your tries total. You will keep getting the same character until you get it right. Once you can obtain a good score on that, go to the second mode in which five letter random groups are given. Write these down without looking at the screen and check them when the group is completed. Incidentally, the characters appear on the screen just after the sound, so a beginner could guess in advance of the characters and subconsciously learn Morse.

The secret of learning Morse code is regular practice every day for 15 to 30 minutes. You should start with the slowest speed and work right through the lessons again. Do not learn lesson 1 at 12 wpm before proceeding to lesson 2.

Each section of the program is broken down according to its function, and these are shown in Table 1. Most of it is quite straightforward, but the code conversion/production process may need a little explanation:

L is an array which contains the binary equivalent of the Morse code character in an array position corresponding to its ASCII value. For example, L(65) contains 6 (the Morse value of A). This is calculated by taking the Morse code for A which is .- This is then written in the reverse order, using a 0 for a dot and a 1 for a dash, thus 10. A 1 is placed on the left-hand side of this number to indicate that the character is complete. The resulting number (110) is then converted from binary and becomes 6. To output the Morse the least significant bit is tested; for a 0 a dot is produced, for a 1 a dash. The number is then shifted one place to the right and the process is repeated until the number is 1, indicating that the entire character has been sent. The duration of the tone is set in line 210, and the inter-element space in variable DE.

The listing shown is for disc BASIC. To convert to Level II, replace line 270 with:

```
270     POKE 16527, A: POKE 16526, B
```

In lines 1510 and 1560 change USR1 to USR.

When typing in the listing, if you see a line which suddenly continues on the next line, press the down arrow (↓), so that the screen format looks correct.

The sound can be heard by connecting an external audio amplifier or by using the cassette recorder in the 'record' mode (with no tape in). The sound can be heard through an earphone plugged in the 'ear' socket.

This program has been successful in helping to improve Morse code receiving speeds, and aids in the initial recognition of Morse characters.

LINES	
100-310	Set up code conversion and speed constants array. POKE machine language program for audio tone into string.
320-390	Select speeds and set delay variables.
400-550	Main menu and branch to appropriate lesson.
560-620	Morse keyboard routine.
630-800	Introduces new letters for the lesson, displays them and creates LS$ using letters from previous lessons.
810-1020	Subroutine to display new letters introduced in this lesson.
1030-1080	Menu to decide which type of lesson is required.
1090-1250	Keyboard recognition routines.
1270-1420	Random group routines.
1430-1480	Subroutine to output a Morse character contained in M.
1500-1570	Subroutine to output a dot or dash with or without a graphics output.
1580-1590	Subroutine setting the delay for the gap between words.
1610-1660	ASCII to Morse code conversion data. 00 indicates no code programmed (may be altered to suit).
1670	Delay values: inter-letter, inter-word pairs.
1680-1710	Machine language for audio output.

Table 1: Program routines

VARIABLES	USE
L(96)	Array with Morse code for conversion.
SP(4)	Array with inter-letter space delay.
SW(4)	Array with inter-word space delay.
BL$	String array with machine language program for producing audio tones.
LS$	String variable with the current lesson's characters.
M	Morse characters used by 'Morse out' routine
GR	Variable = 0 if dots and dashes are to be displayed graphically, otherwise = 1.

Table 2: The use of some variables

Program Listing

```
120   CLEAR 100
130   DEFINT A-Z
140   DIM L(96)
150   FOR A=32 TO 95
160   READ L(A)
170   NEXT
180   FOR A=1 TO 4
190   READ SP(A),SW(A)
200   NEXT
210   TS=96:TL=TS*3:REM**TIME OF TONE
220   BL$=STRING$(35,"A")
230   A=PEEK(VARPTR(BL$)+2)
240   B=PEEK(VARPTR(BL$)+1)
250   AD!=A*256+B
260   IF AD!>32768 THEN C=AD!-65536 ELSE C=AD!
270   DEFUSR1=C:CMD"T"
280   FOR A1=C TO C+29
290   READ T
300   POKE(A1),T
310   NEXT
320   CLS:PRINT CHR$(23);" ** MORSE TRAINER **"
330   PRINT:PRINT"SELECT SPEED ---------
      1 = 6  WORDS/MIN
      2 = 8  WORDS/MIN
      3 = 10 WORDS/MIN
      4 = 12 WORDS/MIN
340   K$=INKEY$:IF K$="" THEN 340
350   PRINT K$;" SPEED"
360   T=ASC(K$)
370   IF T>52 OR T<49 THEN PRINT"PLEASE ENTER 1 TO
      4":GOTO 340
380   DE=SP(VAL(K$))
390   WD=SW(VAL(K$))
400   CLS:PRINT CHR$(23)"MORSE TRAINER MENU"
410   GR=0:NW=0:R=0
420   PRINT"1 - LESSON ONE (EISHTMO)"
430   PRINT"2 - LESSON TWO (AUV)"
440   PRINT"3 - LESSON THREE  (NDB)"
450   PRINT"4 - LESSON FOUR (AWJ)"
460   PRINT"5 - LESSON FIVE (CKPG)"
470   PRINT"6 - LESSON SIX (RLQZ)"
480   PRINT"7 - LESSON SEVEN  (FXY)"
490   PRINT"8 - LESSON EIGHT (0123456789)"
500   PRINT"9 - KEYBOARD SENDING"
510   PRINT"ANY OTHER KEY TO RESET SPEED"
520   K$=INKEY$:IF K$="" THEN 520
530   IF ASC(K$)>57 OR ASC(K$)<49 THEN 320
540   SW=0:LS$=""
550   ON VAL(K$) GOTO 780,760,740,720,700,680,
      660,630,560
560   CLS:PRINT CHR$(23);"MORSE KEYBOARD - ENTER
      FOR MENU"
570   K$=INKEY$:IF K$="" THEN 570
580   IF K$=CHR$(13) THEN 400
590   M=L(ASC(K$))
600   IF M=0 THEN GOSUB 1580 ELSE GOSUB 1430
610   PRINT TAB(15);K$
620   GOTO 570
630   L$="0123456789"
640   GOSUB 810
650   GOTO 1030
660   LS$="FXY"
670   GOSUB 810
680   LS$=LS$+"RLQZ"
690   IF NW=0 THEN GOSUB 810
700   LS$=LS$+"CKPG"
710   IF NW=0 THEN GOSUB 810
720   LS$=LS$+"AWJ"
730   IF NW=0 THEN GOSUB 810
740   LS$=LS$+"NDB"
750   IF NW=0 THEN GOSUB 810
760   LS$=LS$+"AUV"
770   IF NW=0 THEN GOSUB 810
780   LS$=LS$+"EISHTMO"
790   IF NW=0 THEN GOSUB 810
800   IF R=1 THEN 400 ELSE 1030
810   CLS:PRINT CHR$(23);"LESSON ";VAL(K$);" --
      IN WHICH WE LEARN"
820   PRINT
830   IF K$="8" THEN PRINT"NUMBERS ";
      ELSE PRINT"LETTERS ";
840   FOR A=1 TO LEN(LS$)
850   PRINT MID$(LS$,A,1);"[SPC]";
860   NEXT
870   PRINT
880   FOR A=1 TO 500:NEXT A
890   GR=0
900   FOR A=1 TO LEN(LS$)
910   K$=MID$(LS$,A,1)
920   M=L(ASC(K$))
930   GOSUB 1430
940   PRINT TAB(11);K$
950   GOSUB 1580
960   NEXT
970   PRINT"PRESS 'R' TO REPEAT "
980   PRINT"ENTER FOR MENU"
990   PRINT"ANY KEY TO CONTINUE"
1000  K$=INKEY$:IF K$="" THEN 1000 ELSE
      IF K$="R" THEN 900
1010  IF K$=CHR$(13) THEN R=1
1020  NW=1:RETURN
1030  CLS:PRINT CHR$(23);"PLEASE SELECT
      AN OPTION"
1040  PRINT"1 - KEYBOARD RECOGNITION
      I GIVE A SOUND AND YOU
      MATCH IT ON THE KEYBOARD
      2 - RANDOM GROUPS
      I GIVE YOU 12 GROUPS AND YOU
      TAKE THEM DOWN WITHOUT LOOKING"
1050  PRINT"PRESS ENTER TO SELECT AGAIN"
1060  K$=INKEY$:IF K$="" THEN 1060
1070  IF K$="2" THEN 1260
1080  IF K$<>"1" THEN 400
1090  CLS:PRINT CHR$(23);"ECHO EACH CHARACTER
      WHEN YOU HEAR IT"
1100  PRINT"[3 SPC]*** SCORE ***"
1110  PRINT"CORRECT[7 SPC]OUT OF"
1120  PRINT@960,"PRESS ENTER FOR MENU";
1130  GR=1:REM**TURN OFF GRAPHICS
1140  K1$=MID$(LS$,RND(LEN(LS$)),1)
1150  M=L(ASC(K1$))
1160  PRINT@192,CHR$(30);FT,AT
1170  GOSUB 1580
1180  PRINT@320,CHR$(30);
1190  GOSUB 1430
1200  K$=INKEY$;IF K$="" THEN 1200
1210  IF K$=CHR$(13) THEN 1030
1220  PRINT@320,K$;
1230  IF K$<>K1$ THEN AT=AT+1:PRINT" *** NO
      TRY AGAIN ***":GOTO 1150 ELSE PRINT
      "  -OK-"
1240  FT=FT+1:AT=1+AT
1250  GOTO 1140
1260  CLS:GR=1:PRINT CHR$(23);
1270  PRINT"RANDOM GROUPS"
1280  PRINT
1290  FOR A=1 TO 1000:NEXT A
1300  FOR A=1 TO 12
1310  FOR AW=1 TO 5
1320  K$=MID$(LS$,RND(LEN(LS$)),1)
1330  M=L(ASC(K$))
1340  GOSUB 1430
1350  PRINT"[SPC]";K$;
1360  NEXT
1370  PRINT
1380  GOSUB 1580
1390  NEXT
1400  PRINT:PRINT"HIT ENTER FOR MENU
      ANY KEY TO REPEAT"
1410  K$=INKEY$:IF K$="" THEN 1410
1420  IF K$=CHR$(13) THEN 1030 ELSE 1260
1430  T=(M AND 1)+1
1440  ON T GOSUB 1500,1550
1450  M=M/2
1460  IF M<>1 THEN 1430
1470  FOR A1=1 TO DE
1480  NEXT A1
1490  RETURN
1500  IF GR=0 THEN PRINT". ";
1510  X=USR1(TS)
1520  FOR A1=1 TO 23
1530  NEXT A1
1540  RETURN
1550  IF GR=0 THEN PRINT"- ";
1560  X=USR1(TL)
1570  GOTO 1520
1580  FOR A1=1 TO WD
1590  NEXT A1
1600  RETURN
1610  DATA 0,0,94,0,0,0,0,94,45,109,0,0,115,97,106,41
1620  DATA 63,62,60,56,48,32,33,35,39,47
1630  DATA 71,0,0,0,0,76,0
1640  DATA 6,17,21,9,2,20,11,16,4,30,13,18,7,5,15,22
1650  DATA 27,10,8,3,12,24,14,25,29,19
1660  DATA 0,0,0,0,0,0
1670  DATA 219,565,131,360,79,238,46,161
1680  REM**MACHINE CODE FOR TONE BLIP
1690  DATA 205,127,10,14,9,219,255,203,
      119,40,2,203,209,6
1700  DATA 100,0,16,253,121,238,3
1710  DATA 211,255,79,43,124,181,32,240,201
```

The 4th Personal Computer World Show

MIXING BUSINESS WITH PLEASURE

This year, *The Personal Computer World Show* will be twice the size of last year's event. Almost every big name (and a lot of smaller ones) in the micro-electronics industry will be represented somewhere in our new style exhibition. (In the September issue of *PCW* you will find a complete list of companies and organisations participating). And many of the products will be on display for the first time in this country.

We've divided the Show into two broad areas of interest. A massive array of business and professional applications upstairs and a mouthwatering range of hobbyist orientated products downstairs. Downstairs, too, you'll be able to watch a battle of electronic wits in the 2nd European Microcomputer Chess Championship or talk to any one of the many representatives from computer societies and the ComputerTown UK! network.

Whatever you're looking for in the microcomputing field, or even if you're not certain what you *should be* looking for, you'll find it at The 4th Personal Computer World Show. You don't have to leave your spouse or the kids behind, either. We have designed the Show deliberately to cater for the widest possible spectrum of visitors. And children under eight years old will be admitted free.

Now, who says you can't mix business with pleasure?

The 4th Personal Computer World Show

REDUCED ENTRY

VOUCHER **50p Off** VOUCHER

Take this voucher to the 4th Personal Computer World Show at the Cunard Hotel Hammersmith on 10-12 September 1981 and you will receive a 50p discount on the £2.00 entry fee. Not exchangeable for cash.

The 4th Personal Computer World Show

The 4th Personal Computer World Show

Cunard Hotel, Hammersmith
10th, 11th, 12th September 1981

Can you afford *not* to be there?

Our monthly listing turns to hard copy units this time around.

The choice of low-cost printers for the microcomputer user has expanded rapidly over the last few years with the introduction of new technology. Prices have also come tumbling down as the market has expanded, so that selecting a device is an even harder task — hence the inclusion of a regular Buyer's Guide in the magazine.

The following pages list all the suitable printers that we know about which are available on the UK market, and the purpose of this introduction is to help the potential purchaser get the best out of the information presented.

As far as we can we have listed the major UK source of supply of each device or family of devices, whether a distributor or the actual manufacturer, and it is to this address that you should write if you have any enquiries or problems locating a local source of supply.

Heading It Up

There are several ways of getting a character onto a piece of paper but these can be classified into two major categories, impact and non-impact. The former category includes 'dot-matrix', 'daisywheel' and 'golfball' types whereas the latter include 'electrostatic' and 'thermal' types. The relevant entry in the product list is **Face**. A matrix printer, whether impact or not, creates its characters by using a set of needles. The number used to create each character is given under the **Head size** entry. Basically, a 5 by 7 head will not be able to produce as good a character as a 9 by 7 head: the former type cannot produce descenders on letters such as 'p', 'q' and 'g'. Thermal and electrostatic printers require special paper rather than using a conventional typewriter ribbon to create the image on normal paper. Daisy and golfball type printers produce a much higher quality type in a manner similar to that used by a conventional typewriter. They are normally used for correspondence and tend to be much more expensive.

Connecting It Up

The **Interface** is the method of connection to your micro; serial, parallel, etc. Several printers are offered with custom interfaces for certain popular micros — check the **Options** entry further down the list for these. If a serial interface is available the speed at which the micro can send information is given in the **Baud rates** entry.

Obviously the speed at which the device is capable of putting the characters onto the paper is important, and this is shown in the **Print speed** entry (cps stands for characters per second). A note specifying 'bi-directional' against this entry means that the printing head is capable of printing backwards — you don't have to wait until the head has returned to the left-hand margin. Because of this a bi-directional 120cps printer will actually be able to print faster than a 120cps mono-directional device.

The way the printer handles the paper is shown in the **Paper feed** entry. Friction feed is similar to a normal typewriter, OK for single sheets but not so good for continuous stationery. Sprocket feed is basically the same as friction feed except that there are pegs mounted on the end of the platten which engage in the holes in continuous stationery and keep it straight. Tractor feed is the best of all if you are using continuous stationery. It can usually be adjusted for various widths of paper.

Colums Of Type

The **Columns** entry tells you how many 'normal'-sized characters can be printed on each line, a hang-over from the days of machines like the faithful Teletype. An entry under **Type sizes** tells you if the printer can produce different sizes of character; expanded and compressed are generally available on matrix printers.

Some printers offer **Graphics** characters as part of the normal font built into the machine, and others can be user-programmed with special characters or can produce 'High-res' dot graphics.

In general, the quoted **Price** is the end user cost of the printer but,as prices change all the time, it is well worth shopping around for a bargain.

The Choice Of Options

The entries under **Options** and **Notes** detail any special extras available and any special qualities that the printer might have. If you are looking for a printer to go with a simple personal computer then you are probably not interested in a high quality correspondence type, conversely if you expect to put a large amount of paper through your machine then you must be prepared to pay for a device capable of coping with that kind of volume.

If you are considering a printer for your business then you might have thought of using multi-part stationery. If you have, it is essential to check that the device can cope with this type of load; a normal type will simply not stand up to the strain.

BUYER'S GUIDE

ADCOMP

ADCOMP X80 SP
Dist:- Roxburgh Printers,
22 Winchelsea Road,
Rye, East Sussex
07973-3777

Face:-	Dot
Interface:-	RS232/IEEE/Centronics/ /20mA
Feed:-	Sprocket/Tractor
Head Size:-	8x8
Baud Rates:-	50-9600
Print Speed:-	100cps (bi-directional)
Col:-	80/96
Type Sizes:-	—
Graphics Option:-	Yes
Price:-	£795 - £840

Notes:- Intelligent bi-directional feed printer plotter with a variety of fonts.

ANADEX

DP-1000
Dist:- Anadex Ltd
Dorna House, Guildford Road,
West End, Woking, Surrey
09905-6333

+ regional outlets

Face:-	Dot
Interface:-	RS232/20mA/Centronics
Feed:-	Friction
Head Size:-	5x7
Baud Rates:-	110-2400
Print Speed:-	50cps
Col:-	40
Type Sizes:-	2
Graphics Option:-	No
Price:-	£400

Options:- Choice of the 3 indicated interfaces
Notes:- 40 column version of DP-8000 with slightly reduced facilities.

DP-8000

Face:-	Dot
Interface:-	RS232/20mA/Centronics
Feed:-	Sprocket
Head Size:-	9x7
Baud Rates:-	110-9600
Print Speed:-	112cps bi-directional
Col:-	80
Type Sizes:-	2
Graphics Option:-	—
Price:-	£500

Options:- Large character buffer, other interfaces
Notes:- General purpose dot matrix machine.

DP-9500

Face:-	Dot
Interface:-	RS232/20mA/Centronics
Feed:-	Tractor
Head Size:-	9x9 or 9x7
Baud Rates:-	110-9600
Print Speed:-	200cps bi-directional
Col:-	132/220
Type Sizes:-	2
Graphics Option:-	Yes
Price:-	£895

Options:- Extended character buffer.
Notes:- 132 column system with expansion to 176 column with coms control. High density graphics.

DP-9501

Face:-	Dot
Interface:-	RS232/20mA/Centronics
Feed:-	Tractor
Head Size:-	9x11
Baud Rates:-	110-9600
Print Speed:-	200cps bi-directional
Col:-	—
Type Sizes:-	2
Graphics Option:-	Yes
Price:-	£995

Notes:- Extended carriage version of 9500 with higher density plotting.

ANDERSON JACOBSON

AJ 860
Manuf:- Anderson Jacobson
752 Deal Avenue, Slough,
Berkshire SL1 4SJ
Slough 25172

Also Manchester office

Face:-	Dot
Interface:-	RS232
Feed:-	Tractor
Head Size:-	9x5
Baud Rates:-	110-1200
Print Speed:-	120cps bi-directional
Col:-	132
Type Sizes:-	2
Graphics Option:-	Yes
Price:-	£—

Notes:- True descender matrix printer that gives both graphics and full APL character set.

AJ 832

Face:-	Daisy
Interface:-	RS232
Feed:-	Friction
Head Size:-	N/A
Baud Rates:-	110-300
Print Speed:-	30cps
Col:-	132/156
Type Sizes:-	Various
Graphics Option:-	Yes
Price:-	£2,560

Options:- Tractor option, 45cps printing option.
Notes:- Daisy wheel printer capable of both graphics plotting and APL printing. IBM 2741 compatible option.

AJ 880

Face:-	Dot
Interface:-	RS232
Feed:-	Friction
Head Size:-	7x9
Baud Rates:-	110-9600
Print Speed:-	30cps
Col:-	132/216
Type Sizes:-	—
Graphics Option:-	—
Price:-	£899

Options:- Tractor feed.
Notes:- Low cost APL terminal.

BASE 2

Z-800
Dist:- Zero One Electronics
36 Oaklands Avenue,
Thornton Heath, Surrey CR4 7PH
01-689 7924

Also Intelligent Artefacts

Face:-	Dot
Interface:-	RS232/20mA/ Centronics/IEEE
Feed:-	Tractor/Friction
Head Size:-	5x7
Baud Rates:-	75-9600
Print Speed:-	100cps
Col:-	64/132
Type Sizes:-	2
Graphics Option:-	Yes
Price:-	£375

Options:- User definable font.
Notes:- Supplier also runs a service and repair centre and supplies ribbons and paper.

CENTRONICS

MICROPRINTER P1
Manuf:- Centronics Data Computer (UK) Ltd.,
Victoria Way, Burgess Hill, Sussex RH15 9NU
04446-56011

All prices are one-off OEM. Wide UK distribution network including Sintrom, Bytech, Datac, Hamilton Rentals, Rair, Comma, Dacoll and MIBF.

Face:-	Dot Electrostatic
Interface:-	Centronics
Feed:-	Friction
Head Size:-	5x8
Baud Rates:-	—
Print Speed	150 lpm
Col:-	132
Type Sizes:-	3
Graphics Option:-	—
Price:-	£190

Options:- Teletex/Prestel interface @ £375
Notes:- Software selectable line and type sizes.

MODEL 150 UPDATE

Face:- Dot
Interface:- Centronics
Feed:- Tractor/Friction
Head Size:- 7x9
Baud Rates:- —
Print Speed:- 150cps (bi-directional)
Col:- 80
Type Sizes:- 2
Graphics Option:- —
Price:- —

Options:- International character set, RS232 interface.

MODEL 152 UPDATE

Face:- Dot
Interface:- Centronics
Feed:- Tractor/Friction
Head Size:- 7x9
Baud Rates:- —
Print Speed:- 150cps (bi-directional)
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- —

Options:- International character set, RS232 interface.

MODEL 700

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 60cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £890

Notes:- Conventional low speed matrix printer.

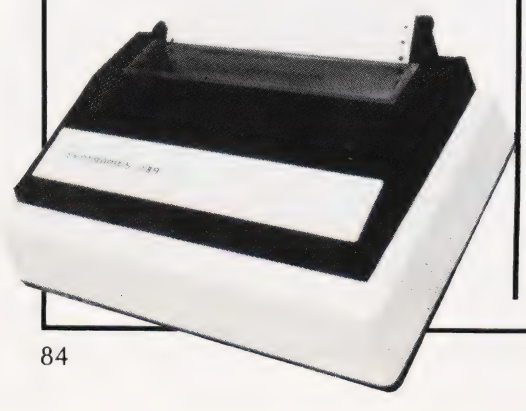
MODEL 701

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 60cps bi-directional
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £980

MODEL 702

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 7x7
Baud Rates:- —
Print Speed:- 120 cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £1,210

Notes:- Faster version of 701 with extra form controls.



MODEL 703

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 7x7
Baud Rates:- —
Print Speed:- 150cps
Col:- 132
Type Sizes:- 2
Graphics Option:- Yes
Price:- £1,360

Options:- Graphics plotting option.

MODEL 704

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- choice
Baud Rates:- 110-9600
Print Speed:- 150cps bi-directional
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £1,360

Options:- Stand, Buffer, "hush" kit.
Notes:- Large carriage high quality matrix printer.

730 MINIPRINTER

Face:- Dot
Interface:- Centronics
Feed:- Tractor/Friction
Head Size:- 7x7
Baud Rates:- —
Print Speed:- 100cps
Col:- 80
Type Sizes:- 2
Graphics Option:- —
Price:- £375
End user

Options:- Serial interface (730-4).

737 MINIPRINTER

Face:- Dot
Interface:- Centronics
Feed:- Tractor/Friction
Head Size:- Nx9 or 7x8
Baud Rates:- —
Print Speed:- 50 or 80cps
Col:- 80
Type Sizes:- 2
Graphics Option:- —
Price:- £425
End user

Options:- Serial interface version (737-4)
Notes:- Unit capable of proportional spacing and justification under micro control.

MODEL 739 UPDATE

Face:- Dot
Interface:- Centronics
Feed:- Friction/Sprocket/Tractor
Head Size:- nx9 or 7x8
Baud Rates:- —
Print Speed:- 80-100cps (bi-directional)
Col:- 80-132
Type Sizes:- 3
Graphics Option:- Yes
Price:- —

Options:- Serial interface, Text buffer.
Notes:- Quieter model than 737 with pin-addressable graphics. Faster than 737 and also includes TOF.

MODEL 753

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- Nx9
Baud Rates:- —
Print Speed:- 100-150cps bi-directional
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £1,360

Options:- Stand, Various electronic options.
Notes:- Correspondence printer with proportional spacing.

MODEL 779

Face:- Dot
Interface:- Centronics
Feed:- Friction
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 60cps
Col:- 80/132
Type Sizes:- 2
Graphics Option:- —
Price:- £370

Options:- Tractor feed.
Notes:- The original micro printer as supplied by Tandy.

MODEL 780

Face:- Dot
Interface:- Centronics
Feed:- Friction
Head Size:- 9x7
Baud Rates:- —
Print Speed:- 60cps
Col:- 80/132
Type Sizes:- 2
Graphics Option:- No
Price:- £830

Notes:- Upmarket version of 779 with better quality head.

MODEL 781

Face:- Dot
Interface:- Centronics
Feed:- Friction
Head Size:- 9x7
Baud Rates:- —
Print Speed:- 60cps
Col:- 80/132
Type Sizes:- 2
Graphics Option:- No
Price:- £930

Notes:- Bi-directional version of 780.

DRE

8810 UPDATE

Dist:- Geveke Electronics,
RMC House, Vale Farm Road,
Woking, Surrey GU21 1DW
04862-71337

Face:- Dot
Interface:- RS232/20mA/Centronics
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- 110-9600
Print Speed:- 120cps (bi-directional)
Col:- —
Type Sizes:- 3
Graphics Option:- Yes
Price:- —

Options:- Paper stacker.

8830/40 UPDATE

Face:- Dot
Interface:- RS232/20mA/Centronics
Feed:- Tractor
Head Size:- 9x7 or 9x9
Baud Rates:- 110-9600
Print Speed:- 180/240cps (bi-directional)
Col:- —
Type Sizes:- 4
Graphics Option:- Yes
Price:- —

Options:- Detached keyboard, VFU, stand.

8910/20

UPDATE

Face:- Dot
Interface:- RS232/20mA/Centronics
Feed:- Friction
Head Size:- nx9
Baud Rates:- 110-9600
Print Speed:- 160 or 240cps (bi-directional)
Col:- –
Type Sizes:- 2
Graphics Option:- Yes
Price:- –

Options:- Detached keyboard, VFU, stand.
Notes:- Correspondence quality drafting printer capable of proportional justfication.

DATAROYAL

DATAROYAL IPS 5000
Dist:- Facit Data Products Ltd.
Maidstone Road, Rochester, Kent.
0634-401721

Face:- Dot
Interface:- RS232/Centronics
Feed:- Tractor
Head Size:- 9x9
Baud Rates:- 110-9600
Print Speed:- 125cps
Col:- 80/136
Type Sizes:- 2
Graphics Option:- –
Price:- £774 - 910

Options:- Large 136 column platten, 2K buffer, 20mA interface.
Notes:- Slightly less enhanced versions of FACIT 4525/6.

DATAPRODUCTS

UPDATE

T80
Dist:- Pericom Data Systems Limited,
1/3 Burners Lane, Kiln Farm,
Milton Keynes, Bucks.
0908-564747

Face:- Dot/Thermal
Interface:- RS232/20mA/Parallel/Centronics
Feed:- Friction
Head Size:- 7x5
Baud Rates:- 110-9600
Print Speed:- 80cps
Col:- –
Type Sizes:- 1
Graphics Option:- Yes
Price:- From £950

Options:- Interfaces for Burroughs, Apple II, TRS80, Intellec MDS, Page Buffer.

M200

UPDATE

Face:- Dot
Interface:- Parallel/Centronics/RS232/20mA
Feed:- Tractor
Head Size:- 7x7
Baud Rates:- 75-19200
Print Speed:- 340cps
Col:- –
Type Sizes:- Various
Graphics Option:- No
Price:- £1495

Options:- VFU, Acoustic Cabinet, Compressed Print.
Notes:- Forms Length Select Switch, Pedestal, Diagnostic Display and Expanded Print Facility fitted as standard.

DIABLO

630
UPDATE
Dist:- Geveke Electronics,
RMC House, Vale Farm Road,
Woking, Surrey GU21 1DW.
04862-71337
Many suppliers including Pericom

Face:- Daisy
Interface:- RS232/20mA
Feed:- Friction
Head Size:- N/A
Baud Rates:- 110-9600
Print Speed:- 40cps (bi-directional)
Col:- 132
Type Sizes:- Various
Graphics Option:- Yes
Price:- Approx £1400

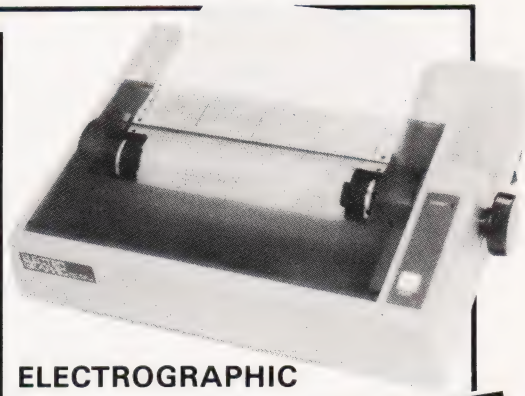
Options:- Tractor and sheet feeders, bi-directional paper feed.
Notes:- High quality correspondence printer.

DIGITRONIX

DIGITRONIX MINI PRINTER
Manuf:- Digitronix Ltd,
10 Burners Lane, Kiln Farm Industrial Estate,
Milton Keynes.
0908-566888

Face:- Electrostatic
Interface:- RS232/20mA
Feed:- Friction
Head Size:- –
Baud Rates:- 110-4800
Print Speed:- 64cps
Col:- 32
Type Sizes:- 2
Graphics Option:- Yes
Price:- £195

Options:- Different font or graphics set
Notes:- Electrosensitive paper printer for data logging etc.



ELECTROGRAPHIC

EG700
UPDATE
Dist:- Electrographic Peripherals,
Printinghouse Lane,
Hayes, Middx UB3 1AP.
01-573 1826

Face:- Dot
Interface:- Parallel
Feed:- Sprocket
Head Size:- 5x7
Baud Rates:- –
Print Speed:- 80cps
Col:- 80
Type Sizes:- 2
Graphics Option:- High-res
Price:- £275

Options:- RS232 interface with 1K buffer.
Notes:- Printing head can be controlled to produce dot resolution graphics.

EPSON

EPSON TX 80
Dist:- Westrex,
Bilton Fairway Estate, Long Drive,
Greenford, Middx.
01-578 0957

Micro peripherals and others

Face:- Dot
Interface:- Centronics
Feed:- Tractor/Friction
Head Size:- 5x7 or 6x7
Baud Rates:- –
Print Speed:- 125cps
Col:- –
Type Sizes:- 2
Graphics Option:- Yes
Price:- £395

Options:- Various micro interfaces including Pet, Apple, Tandy and Sharp
Notes:- PET graphics compatible printer.

MX 80-T

Face:- Dot
Interface:- Centronics
Feed:- Sprocket
Head Size:- 9x9
Baud Rates:- 110-9600 (RS232)
Print Speed:- 80cps bi-directional
Col:- 80
Type Sizes:- 3
Graphics Option:- Yes
Price:- £360

Options:- As TX 80 plus RS232 and IEEE interfaces.

MX 80-FT

Face:- Dot
Interface:- Centronics
Feed:- Friction/Tractor
Head Size:- 9x9
Baud Rates:- 110-9600 (RS232)
Print Speed:- 80cps bi-directional
Col:- 80
Type Sizes:- 3
Graphics Option:- Yes
Price:- £399

Options:- As MX 80-T.

MX 80-2

Face:- Dot
Interface:- Centronics
Feed:- Friction/Tractor
Head Size:- 9x9
Baud Rates:- 110-9600 (RS232)
Print Speed:- 80cps bi-directional
Col:- 80
Type Sizes:- 3
Graphics Option:- High res
Price:- £420

Options:- As MX 80-T.

MX 70

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 5x7
Baud Rates:- —
Print Speed:- 80cps
Col:- 80
Type Sizes:- 3
Graphics Option:- High res
Price:- £260

Options:- Apple, Tandy and Sharp interfaces only.

MX 100

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 9x9
Baud Rates:- —
Print Speed:- 80cps bi-directional
Col:- 132
Type Sizes:- 3
Graphics Option:- High res
Price:- £TBA

Notes:- New model: check with distributor.

FACIT

FACIT 4520/1
Dist:- Facit Data Products
Maidstone Road, Rochester, Kent.
0634-401721

Face:- Dot
Interface:- RS232/Centronics
Feed:- Friction
Head Size:- 9x7
Baud Rates:- —
Print Speed:- 80cps
Col:- 80/132
Type Sizes:- —
Graphics Option:- —
Price:- £583

Options:- Tractor feed (4521).
Notes:- Intelligent, bi-directional matrix printer.

FACIT 4525/6

Face:- Dot
Interface:- RS232 Centronics
Feed:- Tractor
Head Size:- 9x9
Baud Rates:- —
Print Speed:- 150cps
Col:- 80/132
Type Sizes:- —
Graphics Option:- —
Price:- £890-1046

Options:- 132 column version (4526)
Notes:- Bi-directional printer, can be equipped with most European fonts.

FACIT 4530

Face:- Dot
Interface:- RS232/Centronics/20mA
Feed:- Tractor
Head Size:- 5x7 or 9x7
Baud Rates:- —
Print Speed:- 200cps
Col:- 132/198
Type Sizes:- Various
Graphics Option:- —
Price:- £1,628

Notes:- Microcontrolled printer, capable of bar code printing.

FACIT 4540

Face:- Dot
Interface:- RS232/Parallel/ Centronics/IEEE/20mA
Feed:- Tractor
Head Size:- 7x9 or 9x9
Baud Rates:- —
Print Speed:- 250cps
Col:- 155
Type Sizes:- —
Graphics Option:- —
Price:- £2,764-3,040

Options:- Keyboard unit (4610), Graphics (4542).

GENERAL ELECTRIC (USA)

TERMINET 200
Dist:- International General Electric of New York, 111 Park Road, London NW8 7JL
01-402 4100

Distributors include Zygal & Middlectron.

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 7x9
Baud Rates:- 110-1200
Print Speed:- 200cps
Col:- 136/224
Type Sizes:- —
Graphics Option:- Yes
Price:-

Notes:- Available as ASR, KSR or forms access printer with wide range of print formats.

TERMINET 2000

Face:- Dot
Interface:- RS232
Feed:- Friction
Head Size:- 7x9
Baud Rates:- —
Print Speed:- —
Col:- —
Type Sizes:- —
Graphics Option:- —
Price:-

Options:- Tractor feed, character buffer, modem.
Notes:- KSR terminal unit offering three-part form handling and various print formats.

HEATH ELECTRONICS

H14
Dist:- Heath Electronics
Bristol Road, Gloucester GL2 6EE
0452-29451

+ London shop — 01-636 7349

Face:- Dot
Interface:- RS232/20mA
Feed:- Tractor
Head Size:- 5x7
Baud Rates:- 110-4800
Print Speed:- 135cps
Col:- 80/132
Type Sizes:- 3
Graphics Option:- —
Price:- £413 (kit) — £592 (built)

Notes:- High quality reliable printer with no frills.

HEWLETT PACKARD

HP 2631B
Dist:- Hewlett Packard Ltd.
308-314 Kings Road,
Reading, Berkshire RG1 4ES
0734-61022

Face:- Dot
Interface:- RS232/Centronics Centronics/IEEE
Feed:- Tractor
Head Size:- 7x9
Baud Rates:- 110-2400
Print Speed:- 180cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £2,110

Options:- Graphics copy option.
Notes:- Software selectable print densities and form sizes.

HP 2635B

Face:- Dot
Interface:- RS232/20mA Centronics/IEEE
Feed:- Tractor
Head Size:- 7x9
Baud Rates:- 110-2400
Print Speed:- 180cps
Col:- 132
Type Sizes:- 2
Graphics Option:- —
Price:- £2,315

Notes:- KSR version of 2631 with same facilities.

HONEYWELL

HONEYWELL S10
Dist:- MBS Terminals
Aldwych House, Madeira Road,
West Byfleet, Surrey KT14 6BA
09323-53151

Face:- Dot
Interface:- RS232
Feed:- Friction/Sprocket/Tractor
Head Size:- 7x7
Baud Rates:- —
Print Speed:- 80cps (bi-directional)
Col:- 80
Type Sizes:- —
Graphics Option:- —
Price:- £510

HONEYWELL S30

Face:- Dot
Interface:- RS232/Centronics
Feed:- Friction/Sprocket/Tractor
Head Size:- 7x7
Baud Rates:- —
Print Speed:- 80cps (bi-directional)
Col:- 132
Type Sizes:- —
Graphics Option:- —
Price:- £690

INTEGREX

CX 80
Manuf:- Integrex Ltd.,
Portwood Industrial Estate, Church Gresley,
Burton on Trent, Staffordshire DE11 9PT
0283-215432

Face:- Dot
Interface:- Centronics
Feed:- Tractor
Head Size:- 5x7
Baud Rates:- 300-9600 (RS232)
Print Speed:- 125-150 cps
Col:- 80
Type Sizes:- —
Graphics Option:- Yes
Price:- £895

Options:- RS232, IEEE, Tandy and Apple interfaces.
Notes:- Matrix printer that can print in up to 7 colours. Can be user programmed for High res graphics.

454C

Face:- Dot
Interface:- Parallel
Feed:- Tractor
Head Size:- 9xn
Baud Rates:- 300-9600 (RS232)
Print Speed:- 250cps bi-directional
Col:- 155
Type Sizes:- 2
Graphics Option:- Yes
Price:- £3,950

Options:- Centronics, RS232 and IEEE interfaces.
Notes:- High quality seven colour matrix printer – professional version of CX80.

LEAR SIEGLER

BALLISTIC 300
Dist:- Penny & Giles Recorders Ltd.
Mudeford, Christchurch,
Dorset BH23 4AT
04252-71511

Face:- Dot
Interface:- RS232/20mA
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- 75-9600
Print Speed:- 180cps
Col:- 136
Type Sizes:- –
Graphics Option:- –
Price:- –

Options:- Foreign character sets, 9x9 or 9x12 heads.
Notes:- Micro controlled 'smart' printer with powerful forms control.

LOGABAX

LOGABAX 100
Dist:- Brospa Data
87 Castle Street, Reading,
Berkshire RG1 7ST
0734-589393

Face:- Dot
Interface:- RS232/Parallel/Centronics/IEEE/20mA
Feed:- Tractor
Head Size:- Various
Baud Rates:- 110-9600
Print Speed:- 100cps
Col:-
Type Sizes:- 2
Graphics Option:- No
Price:- £1,152

Options:- Stand and paper handling trays.

LOGABAX 200

Face:- Dot
Interface:- RS232/Parallel/Centronics/IEEE/20mA
Feed:- Tractor
Head Size:- 7x9 or 9x9
Baud Rates:- 110-9600
Print Speed:- 180cps
Col:-
Type Sizes:- 2
Graphics Option:- Yes
Price:- £1,590

Options:- Stand and paper handling trays.
Notes:- Bi-directional matrix printer with expanded and compressed type facility.

LOGABAX LXI200

Face:- Dot
Interface:- RS232/20mA/Centronics
Feed:- Friction/Sprocket/Tractor
Head Size:- 9xn
Baud Rates:- 110-9600
Print Speed:- 180cps (bi-directional)
Col:- –
Type Sizes:- Selectable (various)
Graphics Option:- Yes
Price:- £2,031

Options:- Stand and paper holder
Notes:- Full software controlled matrix printer offering WP quality and facilities.

MASTERPRINT

MASTERPRINT 165
Dist:- MBS Terminals,
Aldwych House, Madeira Road,
West Byfleet, Surrey KT14 6BA.
09323-53151

Face:- Dot
Interface:- RS232/Centronics
Feed:- Tractor
Head Size:- 10x9
Baud Rates:- –
Print Speed:- 90/165cps (bi-directional)
Col:- –
Type Sizes:- 2
Graphics Option:- Yes
Price:- £1,450

Options:- Apple and S100 interfaces, special character sets, high resolution graphics
Notes:- High quality drafting printer with 18 by 9 matrix print capability.

MICROTEK

MICROTEK MT 80P
Dist:- HAL Computers,
133 Woodham Lane, New Haw,
Weybridge, Surrey KT15 3NJ
Weybridge 48346

Face:- Dot
Interface:- RS232/IEEE/Centronics
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- to 9600
Print Speed:- 125cps
Col:- 80/120
Type Sizes:- 2
Graphics Option:- No
Price:- £495 - £550

Options:- Various interfaces, character buffer.
Notes:- 80 or 120 column matrix printer.

NASCOM

IMP
Dist:- Currently available from many local outlets.

Face:- Dot
Interface:- RS232
Feed:- Friction
Head Size:- 7x7
Baud Rates:- 110-9600
Print Speed:- 60 lpm
Col:- 80
Type Sizes:- –
Graphics Option:- Yes
Price:- £325

Options:- Tractor feed, programmable character set.
Notes:- First of a new generation of matrix printers, like the BASE 2 and EPSON.

NEWBURY LABS

8300 RM
Dist:- Newbear Computing Store,
40 Bartholomew Street,
Newbury, Berkshire
0635-30505

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 7x9
Baud Rates:- 110-9600
Print Speed:- 125cps
Col:-
Type Sizes:- 2
Graphics Option:- No
Price:- £525

Options:- Choice of character per line and buffer sizes.
Notes:- General purpose dot matrix printer.

OKI

MICROLINE 80
Dist:- Rohan Computing
52 Coventry Street,
Southam, Warcs CV 0EP
092681-4045

Face:- Dot
Interface:- Centronics
Feed:- Friction
Head Size:- 9x7
Baud Rates:- –
Print Speed:- 80cps
Col:- 80
Type Sizes:- 3
Graphics Option:- Yes
Price:- £399

Options:- Tractor feed, RS232 1200 Baud interface
Notes:- One of the new generation of micro printers for small business and personal use.

MICROLINE 82

Face:- Dot
Interface:- RS232/Centronics
Feed:- Friction/Sprocket
Head Size:- 9x7
Baud Rates:- 1200
Print Speed:- 80cps (bi-directional)
Col:- 80/132
Type Sizes:- 3
Graphics Option:- Yes
Price:- £550

Notes:- Bi-directional version of the MICROLINE 80 with form controls.

MICROLINE 83

Face:- Dot
Interface:- RS232/Centronics
Feed:- Friction/Sprocket
Head Size:- 9x7
Baud Rates:- 1200
Print Speed:- 120cps (bi-directional)
Col:- 132/136
Type Sizes:- 3
Graphics Option:- Yes
Price:- £799

Notes:- Full width version of MICROLINE range.

OLIVETTI

DY 311
Dist:- Dealership currently under negotiation.

Face:- Daisy
Interface:- RS232/IEEE
Feed:- Tractor/Friction
Head Size:- N/A
Baud Rates:- 110-9600
Print Speed:- 32cps
Col:-
Type Sizes:- Various
Graphics Option:- –
Price:- £1,300

Options:- Sheet feeder, 20mA interface
Notes:- High quality daisy system with full proportional spacing and tabbing.

TH 240

Face:- Dot/Thermal
Interface:- RS232
Feed:- Tractor/Friction
Head Size:- 7 pin
Baud Rates:- 110-9600
Print Speed:- 320cps
Col:-
Type Sizes:- –

Graphics Option:- Yes
Price:- £860

Options:- High speed plot, paper handling accessories.
Notes:- Thermal printer capable of producing eight ISO alphabets.

PAPER TIGER

PAPER TIGER
Dist:- Microsense
Finway Road, Hemel Hempstead, Herts HP2 7PS
0442-48151

+ regional outlets inc. Teleprinter Equipment

Face:- Dot
Interface:- RS232/Centronics
Feed:- Tractor/Friction
Head Size:- 7x7
Baud Rates:- 110-1200
Print Speed:- 95cps
Col:- 132
Type Sizes:- 4
Graphics Option:- Yes
Price:- £598

Notes:- Very versatile printer with various built-in options for line length, etc.

PAPER TIGER 460

Face:- Dot
Interface:- RS232/Centronics
Feed:- Tractor
Head Size:- Staggered nx9
Baud Rates:- 300-9600
Print Speed:- 110-160cps bi-directional
Col:- 80
Type Sizes:- 3
Graphics Option:- High res
Price:- £--

PAPER TIGER 560
Dist:- Teleprinter Equipment,
Akeman Street, Tring, Herts HP23 6AJ
044282-4011

Face:- Dot
Interface:- RS232/Centronics
Feed:- Sprocket
Head Size:- Staggered nx9
Baud Rates:- 300-9600
Print Speed:- 110-160 (bi-directional)
Col:- 132
Type Sizes:- 8
Graphics Option:- Yes
Price:- —

Notes:- Full width version of popular matrix printer.

PERTEC

STYLIST 360
Manuf:- Pertec International
10 Portman Road, Reading,
Berkshire RG3 1DU
0734-582115

Face:- Daisy
Interface:- Centronics
Feed:- Friction
Head Size:- —
Baud Rates:- —
Print Speed:- 17cps
Col:- 132/198
Type Sizes:- Various
Graphics Option:- No
Price:- £666

PERTEC P80

Face:- Dot
Interface:- Centronics
Feed:- Friction/Sprocket
Head Size:- 7x9
Baud Rates:- 110-9600
Print Speed:- 80cps (bi-directional)
Col:- 80/120
Type Sizes:- 2
Graphics Option:- No
Price:- £478

Options:- RS232 or 20mA interfaces.

PERTEC P250

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 7x9
Baud Rates:- 110-19,200
Print Speed:- 250cps (bi-directional)
Col:- 132/158/198
Type Sizes:- 3
Graphics Option:- Yes
Price:- £1,311

Options:- Centronics and 20mA interfaces.

QUME

SPRINT 5
Dist:- Facit Data Products Ltd.
Maidstone Road, Rochester, Kent.
0634-401721

Local distribution by: Access Data, Fortronics, Cytec, Wilkes, Rohan, Brospa etc.

Face:- Daisy
Interface:- RS232/20mA/Parallel
Feed:- Tractor/Friction
Head Size:- N/A
Baud Rates:- 110-1200
Print Speed:- 45-55cps
Col:- 132/158
Type Sizes:- Various
Graphics Option:- Yes
Price:- From £1,625

Options:- RO or KSR terminals, single sheet feed
Notes:- High quality correspondence printer.

RICOH

RICOH RP1600
Dist:- Nexos (UK) Ltd.,
Metropolitan House, 1 Hagley Road,
Edgbaston, Birmingham B16 8TG
021-454 2235

Face:- Daisy
Interface:- Centronics
Feed:- Friction
Head Size:- N/A
Baud Rates:- —
Print Speed:- 60cps
Col:- N/A
Type Sizes:- various
Graphics Option:- —
Price:- £1,290

Options:- Various interfaces.
Notes:- Fast commercial daisy wheel for WP and other office applications.

ROBETRON

UPDATE

ROBETRON 1152
Dist:- Penny & Giles,
Mudeford, Christchurch,
Dorset BH23 4AJ.
04252-71511

Face:- Daisy
Interface:- Centronics
Feed:- Friction
Head Size:- N/A
Baud Rates:- —
Print Speed:- 45cps
Col:-
Type Sizes:- various
Graphics Option:- No
Price:- £863

Options:- Tractor feed.
Notes:- East German RO daisywheel type printer.

SANDERS MEDIA

UPDATE

Vario Printer 12/7
Dist:- Real Time Developments,
Caroline House, Invincible Road,
Farnborough, Hants GU14 7QU.
0252-46213

Face:- Dot
Interface:- RS232/Centronics
Feed:- Friction
Head Size:- nxn
Baud Rates:- —
Print Speed:- 30-50 or 120-200cps (bi-directional)
Col:- —
Type Sizes:- up to 11 fonts
Graphics Option:- —
Price:- —

Options:- Roll feed or tractor feed.
Notes:- Extremely high quality matrix printer capable of producing a wide range of typestyles using an 'Infinite Matrix'.

SEIKO

UPDATE

SEIKOSHA GP-80
Dist:- DRG Business Machines,
Unit 8, Lynx Crescent,
Winterstoke Road,
Weston Super Mare BS24 9DW.
0934-416392

Many suppliers including Micro Peripherals etc.

Face:- Dot
Interface:- Centronics
Feed:- Tractor/Friction
Head Size:- 'unihammer'
Baud Rates:- —
Print Speed:- 30cps
Col:- 80
Type Sizes:- —
Graphics Option:- Yes
Price:- £225

Options:- Various interfaces.
Notes:- Amazingly low cost single needle printer capable of reasonable print and graphics quality.

SIGMA

MODEL 801
Dist:- Sigma UK
Unit 2, 106-120 Garrat Lane,
Wandsworth, London SW18
01-870 4524

Face:- Dot
Interface:- RS232/20mA/Centronics
Feed:- Tractor/Friction
Head Size:- 7x7
Baud Rates:- 110-1200
Print Speed:- 132cps
Col:-
Type Sizes:- —
Graphics Option:- —
Price:- £695

TELETYPE

TELETYPE 43
Dist:- Peripheral Hardware Ltd.,
Armfield Close, West Molesey, Surrey.
01-941 4806

Face:- Dot
Interface:- RS232/20mA
Feed:- Tractor/Friction
Head Size:- 7x9
Baud Rates:- —
Print Speed:- 10 or 30cps
Col:- 132
Type Sizes:- —
Graphics Option:- No
Price:-

Options:- IEEE interface, Buffer store, Stand, ASR.
Notes:- High quality matrix terminal available as KSR, ASR or RO. Portable and TTY compatible.

TEXAS INSTRUMENTS

TI 810
Dist:- Texas Instruments,
Manton Lane, Bedford.
0234-67466

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- 110-9600
Print Speed:- 150cps
Col:- 132
Type Sizes:- 2
Graphics Option:- –
Price:- £1,450

Options:- Character sets, various interfaces, form handling.

TI 820

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- 110-9600
Print Speed:- 150cps
Col:-
Type Sizes:- 2
Graphics Option:- –
Price:- £1,450 - £1,650

Notes:- KSR bi-directional with RO option at reduced cost

TI 825

Face:- Dot
Interface:- RS232
Feed:- Tractor
Head Size:- 9x7
Baud Rates:- 110-600
Print Speed:- 75cps
Col:-
Type Sizes:- 2
Graphics Option:- –
Price:- £1,095 - £1,250

Notes:- Slower RO or KSR matrix printer.

TI 743
Face:- Dot Thermal
Interface:- RS232/20mA
Feed:- Friction
Head Size:- 5x7
Baud Rates:- 110-300
Print Speed:- 30cps
Col:-
Type Sizes:- –
Graphics Option:- –
Price:- £995 -£1,105

Notes:- Thermal printer KSR terminal.

TI 745

Face:- Dot Thermal
Interface:- RS232
Feed:- Friction
Head Size:- 5x7
Baud Rates:- 110-300
Print Speed:- 30cps
Col:-
Type Sizes:- –
Graphics Option:- –
Price:- £1,250

Notes:- Integral modem in portable terminal.

TI 763

Face:- Dot Thermal
Interface:- RS232/20mA
Feed:- Friction
Head Size:- 5x7
Baud Rates:- 110-9600
Print Speed:- 30cps
Col:-
Type Sizes:- –
Graphics Option:- –
Price:- £2,195

Options:- Expanded character store.
Notes:- Bubble memory based terminal with 20K internal storage.

TRENDCOM

TCM 100 .
Dist:- Personal Computers Ltd.
194-200 Bishopsgate,
London EC2M 4NR

Face:- Dot Thermal
Interface:- Parallel
Feed:- Friction
Head Size:- 5x7
Baud Rates:- –
Print Speed:- 40cps
Col:- 40
Type Sizes:- –
Graphics Option:- Yes
Price:- £240

Options:- Interfaces for various machines.
Notes:- 40 column thermal printer capable of graphics plotting.

TCM 200

Face:- Dot Thermal
Interface:- Parallel
Feed:- Friction
Head Size:- 5x7
Baud Rates:- –
Print Speed:- 40cps
Col:- 80
Type Sizes:- –
Graphics Option:- Yes
Price:- £340

Options:- Interfaces for various machines.
Notes:- 80 column version of TCM 100.

SILENTYPE
Dist:- Microsense
Finway Road, Hemel Hempstead, Herts HP2 7PS
0442-48151

+ regional outlets

Face:- Dot Thermal
Interface:- Apple
Feed:- Friction
Head Size:- 5x7
Baud Rates:- –
Print Speed:- 40cps
Col:- 80
Type Sizes:- –
Graphics Option:- Yes
Price:- £349

Notes:- Custom interfaced TRENDCOM printer for Apple capable of high density graphics.

WALTERS MICROSYSTEMS

DOLPHIN BD-80P
Manuf:- Walters Microsystems
1 Blenheim Road,
High Wycombe, Bucks
0494-445172

Face:- Dot
Interface:- RS232/20mA/Centronics/IEEE
Feed:- Tractor/Friction
Head Size:- 7x9
Baud Rates:- 50-19,200
Print Speed:- 125cps
Col:- 80/132
Type Sizes:- 2
Graphics Option:- Yes
Price:- £525

Options:- Stand, Buffer, Coms interface.
Notes:- A standard matrix printer with excellent reliability reputation.

DOLPHIN BD-136

Face:- Dot
Interface:- RS232/Parallel/Centronics/IEEE/20mA
Feed:- Friction/Sprocket/Tractor
Head Size:- 9x9
Baud Rates:- –
Print Speed:- 240cps (bi-directional)
Col:- 136
Type Sizes:- –
Graphics Option:- Yes
Price:- £1,200

Notes:- Flexible, intelligent matrix printer capable of a wide formatting range.

WEYFRINGE

MODEL 480
Dist:- Weyfringe
Longbeck Road, Marske,
Redcar, Cleveland TS11 6HQ
0642-470121

Face:- Dot
Interface:- RS232/20mA/Centronics
Feed:- Friction
Head Size:- 5x7
Baud Rates:- 110-9600
Print Speed:- 110cps
Col:- 40
Type Sizes:- 2
Graphics Option:- –
Price:- £475

Options:- Choice of indicated interfaces.
Notes:- Tally roll printer for logging applications.

CENTURY

Face:- Dot
Interface:- RS232/20mA/Centronics
Feed:- Tractor/Friction
Head Size:- 7x9
Baud Rates:- 110-9600
Print Speed:- 110cps
Col:- 96/132
Type Sizes:- 4
Graphics Option:- –
Price:- £945

Options:- Optional PET interface, alternate character set.
Notes:- General purpose machine with form handling facilities, Now available with keyboard.

WHYMARK

WHYMARK 201
Dist:- Whymark Instruments
6 Holmesdale Road,
Reigate, Surrey RH2 0BQ
07372-21753

Face:- Dot
Interface:- RS232/20mA/Centronics/IEEE/Parallel
Feed:- Friction
Head Size:- 7x7
Baud Rates:- 110-4800
Print Speed:- 1 lps
Col:- 40
Type Sizes:- 4
Graphics Option:- –
Price:- £410 - £490

Options:- Label printer, rack mounted, interfaces to order.
Notes:- Tally roll printer with 40 character line.

WHYMARK 801

Face:- Dot
Interface:- RS232/Centronics/IEEE
Feed:- Tractor
Head Size:- nx7
Baud Rates:- 75-9600
Print Speed:- 140cps
Col:- 120
Type Sizes:- 2
Graphics Option:- Yes
Price:- £750

Options:- User definable character set, stand.
Notes:- Intelligent printer with proportional control and absolute alignment.

NEXT MONTH

electronics today INTERNATIONAL

DIY SPEAKERS

ETI has a long-standing tradition of bringing you the very best in hi-fi projects, but we haven't done a speaker design for . . . well, *ever* such a long time. Next month we put things right with this superb design, ideal for those of you looking around for something to bolt onto the back of the System A amplifier you've just finished building. In fact these speakers will do justice to any system; featuring three drive units and a recommended power rating of over 100 W, they out-perform commercial speakers costing twice as much. As well as a kit of parts with all the electronic bits needed, a pre-cut baffle will be available for those people not too happy with a fretsaw.

MAINS REMOTE CONTROL

We promised it to you some months ago and here it is — remote control of domestic appliances using mains-borne signals. A single transmitter can control up to 16 appliances, each one containing a small receiver module which is preset by switches to one of the 16 channels. All you have to do is plug the transmitter into a convenient power socket, press the required channel button followed by 'on' or 'off', and the selected receiver drives a relay according to your instruction. The transmitter can be unplugged and moved around without changing the state of the receivers, and you can select any one of 16 'house codes' so that your system doesn't interfere with that of a neighbour. Turn on the kettle and the toaster without leaving your bed, open and shut the garage door from inside the house — or how about finding a helpful neighbour on the same mains phase and giving him your transmitter when you go on holiday? He can deter burglars by turning your lights on and off without leaving the comfort of his armchair. The possibilities are endless.

dbx RULES OK?

Mention noise reduction to anyone and the name Dolby immediately springs to mind — but an amazing demonstration last month of the new dbx system could herald a dramatic change in the hi-fi scene. A noise level improvement over Dolby C of *30 dB* across the whole audio band is claimed for the Recording Technology Series system, while the reproducible dynamic range approaches that of a live performance. How has this minor miracle been accomplished? A comprehensive technical lecture accompanied the demonstration and next month we'll be telling you just what's going on inside the boxes.

ENLARGER TIMER

Photographers who want to build their own enlarger timer for home printing are generally faced with a choice between the lack of precision offered by a 'rotary pot' design, or the limited number of timing periods available from a rotary switch. Our new design overcomes these difficulties by using a programmable timer IC and a bank of toggle switches which allow timing periods to be set in one-second intervals from 1 s to 255 s. A relay controls the mains supply to the enlarger bulb and the usual Start, Abort and Focus switches are provided.

SOUND BENDER

Want to sound like a Vogon — or even a Ravenous Bugblatter Beast of Traal? Our ring modulator lets you muck about with your vocal chords (or musical chords, if you wish). The simple, single-chip design contains its own built-in oscillator for modulating the input signal (both sine and triangle waveforms are available) and a mix control varies the depth of the effect. A fun little gadget for being silly with.

TAKING SCALPS

Nothing to do with redskins; SCALP stands for Scanned Laser Probe and is the latest method being used by Wharfedale to develop better speakers. In just 15 minutes SCALP can provide an exact three-dimensional picture of the surface vibrations of a speaker cone when a single frequency is fed into it. We'll be taking a look at the technology and techniques involved, and seeing how the system is making speaker design faster, cheaper and easier.

LOOK OUT FOR THE OCTOBER ISSUE ON SALE SEPTEMBER 4th

BACKNUMBERS

If you are thinking of trying to plug some of the holes in your collection of Computing Today then some fast action is required. Stocks of past issues are running extremely low, we only have the issues shown remaining in stock. If you are missing one of these then **now** is the time to order it because the chances are that it won't be in the list next month. All backnumbers cost £1.00 each. For those of you who want copies of articles that are located in issues not available we do offer a photocopying service. Each copy costs £1.00 and information as to its title and publication date should be given. Ordering backnumbers and photocopies could hardly be easier, just fill in the coupon, cut it out and send it to

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145 Charing Cross Road,
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Backnumbers issue list

July 1980
Battle of Britain simulation, Multiple choice exam program, Address list program, Kingdoms game.

August 1980
Multipurpose records program, Conlan language, Floppy discs examined, Systematic programming theory.

September 1980
Pascal overview, PC 1211 reviewed, BASIC dialects, Othello and Ski Run programs.

March 1981
SuperPET review, 6502 programming course, Boolean algebra on micros, Golf simulation.

June 1981
Sinclair's ZX81 reviewed, Versatile A to D converter project, The BBC's software specification, CT's programming standards.

July 1981
Holocaust wargame, Data entry validation routines, Multiple column records program, Media survey.

A very limited number of copies of May and October 1980 are available in addition to the above. Last month's issue is still available as well but has not yet reached the end of its 'shelflife' and is not included for this reason.

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ZX81, 128 user definable graphics kit plus software £12.00. D.Elwin, 20 Baldwin Rd, King's Lynn, Norfolk PE30 4AN.

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UK101 GALACTIC ADVENTURE with real time graphics. £6. SAE for details. Richard Tomlinson, 27 Peplins Way, Brookmans Park, Hatfield, Herts.

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ZX80 GRAPHICS UPDATE. S.A.E. for details. Petry, 3 Lester Drive, Worle, W.S.M. Avon BS22 0NG.

ATOM, FULL M/C debugging monitor in 2K. SAE data — L.Nolan, 99 Fir St., Cadishead, Manchester M30 5AR. £3.75.

ACORN ATOM USERS: Subscribe to "THE ATOM" — a bi-monthly magazine written exclusively for ATOM users. Covers BASIC and m/c programming, with complete, tested programs. Something for every ATOM user. One year's subscription £3.95, from BUG-BYTE, 98-100, The Albany, OLD HALL STREET, LIVERPOOL L3 9EG.

ZX81. THE NEW BOOK by Tim Hartnell "Getting Acquainted with Your ZX81" contains 80 great programs, including a complete draughts game, plus many hints and tips. It is just £4.95 from Users Club, 44 Earls Court Road, Dept CT, London W8.

UK101 8K 16 rows only owners, a m.c. program adding extensive graphical commands to basic. Demonstration program illustrates the ease with which high speed graphics can be incorporated in programs. Mr. Lall, 22 Netley Dell, Letchworth, Herts. £4 incl. SAE for details.

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ZX81 ATOM!

The monthly magazine INTERFACE contains many programs, hints, tips, contact addresses for ZX81, ZX80, Acorn Atom and Proton. Send £1 for a copy of the latest issue, plus details of how to join the National ZX80 and ZX81 Users' Club or the Independent Acorn Atom/Proton Users' Group.

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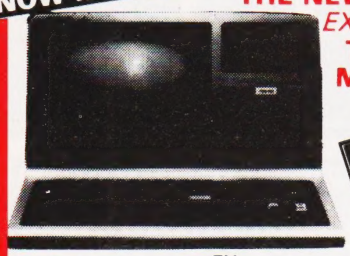

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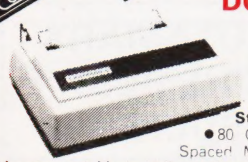

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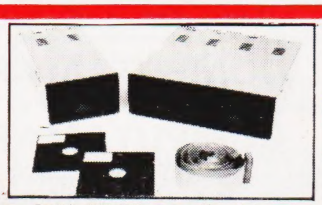

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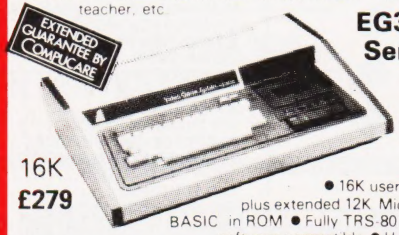

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Lowe Electronics are further enhancing the versatility of the Genie system: we have designed lower case adaptor, sound kit and now colour systems. This will be available from April and is shown in action below. The Video Genie range starts at a recommended retail price of just £325 plus VAT.
Contact Lowe Electronics for full details and a dealer list.

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